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The Ontario Pulp and Paper Industr A Regional Profitability Analysis

ONTARIO ECONOMIC COUNCIL RESEARCH STUDY

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Introduction

The early 1980s provide a good vantage point for an examination of the prospects of Ontario's pulp and paper sector. Pulp and paper mills are the leading (three-digit) manufacturing sector in the country, accounting for nearly 5 per cent of Canadian production workers in manufacturing and 7.6 per cent of value-added in manufacturing.[1] Pulp and paper activity is somewhat less important to the Ontario economy, ranking fifth in terms of value-added (behind motor vehicle parts, iron and steel mills, motor vehicle manufacturers, and miscellaneous machinery and equipment) and sixth in terms of production workers (behind the sectors just listed and commercial printing as well). Still, approximately 2.8 per cent of Ontario's manufacturing employment and 3.5 per cent of value-added in Ontario manufacturing originate in the pulp and paper sector. Since the mid-1970s, however, concern has been expressed that the industry is becoming (or has become) uncompetitive in international markets. In 1979, the federal and provincial governments embarked on a capital assistance program designed to assist the industry in modernizing its plants to meet cost competition from producers in the southern United States.

THE ONTARIO PULP AND PAPER INDUSTRY: OVERVIEW

Table 1.1 shows Ontario's pulp and paper capacities in 1982 and Figure 1.1 shows the geographical locations of pulp and paper mills in the province. The organization of the table by product line reveals the importance of newsprint and kraft (sulphate) pulp within the Ontario industry. Approximately 36 per cent of total capacity is devoted to newsprint production and 26 per cent to dried kraft pulp.[2] Fine papers account for 11 per cent of overall capacity. Newsprint and dried kraft pulp are the products we shall focus on the present study.

Table 1.1 and Figure 1.1 offer some insight into the locational characteristics of

TABLE 1.1

Ontario Pulp and Paper Capacity in 1982 (short tons per day)[a]

Newsprint		
Fort Frances (Boise Cascade)	658	
Iroquois Falls (Abitibi Price)	963	
Kapuskasing (Spruce Falls)	1,080	
Kenora (Boise Cascade)	760	
Red Rock (Domtar)	200	
Thorold (Ontario Paper)	1,000	
Thunder Bay (Abitibi Price—2 mills)	797	
Thunder Bay (Great Lakes)	1,225	
		6,683
Dried kraft pulp[b]		
Dryden (Great Lakes)	430	
Espanola (Eddy)	670	
Fort Frances (Boise Cascade)	225	
Marathon (American Can)	500	
Smooth Rock Falls (Abitibi Price)	358	
Terrace Bay (Kimberly Clark)	1,250	
Thunder Bay (Great Lakes)	1,315	
		4,748
Other dried pulp (sulphite)[b]		
Hawkesbury (CIP)	292	
Thorold (Ontario Paper)	75	
		367
Fine papers		
Cornwall (Domtar)	725	
Dryden (Great Lakes)	200	
Ottawa (Eddy)[c]	185	
St. Catherines (Domtar)[c]	230	
Thorold (Fraser)	270	
Thunder Bay (Abitibi Price)	340	
Toronto (Domtar)[c]	34	
		1,984
Miscellaneous paper and board		
Brampton (IKO)	180	
Brantford (Sonoco)[c]	167	
Espanola (Eddy)	110	
Glen Miller (Trent Valley)[c]	350	
Huntsville (Kimberly Clark)[c]	100	
Kapuskasing (Kimberly Clark)[c]	83	
Mississauga (Domtar)[c]	250	
North Bay (Nordfibre)	130	
Red Rock (Domtar)	650	
Sault Ste. Marie (Abitibi Price)	440	
Scarborough (Atlantic Packaging)[c]	400	

St. Catherines (Kimberly Clark)[c]	90	
Strathcona (Strathcona Paper)[c]	150	
Sturgeon Falls (McMillan Bloedel)	230	
Thorold (Beaver Wood Fibre)[c]	300	
Thorold (Domtar)[c]	70	
Toronto (Belkin Paperboard)[c]	400	
Toronto (Dominion Cellulose)[c]	265	
Trenton (Domtar)	190	
		4,555
Total Ontario		18,337

a 1 metric ton = 1.1 short tons. Short tons per year (tpy) = short tons per day (tpd) multiplied by 350 operating days.
b Market pulp plus shipments to affiliated mills.
c no pulpmill.
SOURCE: *Lockwood's Directory of the Paper and Allied Trades* (1983).

the province's pulp and paper industry. Newsprint and sulphate pulp producers are invariably integrated backward into the logging sector and are, therefore, oriented to the forest resource. The orientation of fine papers is mixed: some producers are located at the resource and others are located at markets to which dried pulp is shipped and repulped for paper manufacture. The miscellaneous paper and paperboard sector is predominantly market-oriented: most producers are dependent on dried pulp inputs from pulpmills elsewhere in the province or outside it. [3] These locational aspects of the industry mean that a comparison of miscellaneous paper and paperboard manufacturing capacity with total provincial capacity tends to overstate the economic importance of the market-oriented sector, since it relies on pulp inputs that may have already been counted as dried pulp capacity at other locations in Ontario. Further, if economic forces were to produce a decline in the important resource-oriented sectors of the industry, market-oriented production in southern Ontario would probably not suffer decline but would instead become more reliant on pulp from outside the province.

Resource-oriented pulp and paper production is crucial to the economic life of many communities in northern Ontario. Towns such as Iroquois Falls, Kapuskasing, and Dryden owe their existence to the industry, and larger centres such as Thunder Bay count pulp and paper activity as a key component of their export base. Any reduction in the level of production in the newsprint and kraft pulp sectors would require a significant reallocation of Ontario's supplies of labour and capital, both from pulp and paper to other industries and from northern resource towns to other areas of the province.

FIGURE 1.1
Pulp and paper mills in Ontario

SOURCE: *Lockwood's Directory of the Paper and Allied Trades* (1983)

The prospective viability of resource-oriented pulp and paper production in northern Ontario has been questioned over the past few years along two fronts. First, industry and government spokesmen have expressed concern that the costs of producing newsprint and sulphate pulp in the province exceed or threaten to exceed relative production costs in alternative locations. The usual benchmark for cost comparisons has been the southern United States, where newsprint and pulp capacities have increased substantially over the past three decades. Producers in this region ship their products to cities in the northeastern and midwestern U.S. that are also the principle destinations of Ontario's pulp and paper exports. Owing in part to regional population shifts within the United States, the northeastern and midwestern newsprint markets have expanded very little since the early 1970s. Despite pressures from new capacity in the southern U.S. and slow market growth, Ontario newsprint producers have managed to hold on to approximately constant shares of newsprint comsumption in the midwestern U.S. (43–44 per cent) and the northeastern states (10–11 per cent) during the 1970s (Ontario 1981, 35). Newsprint capacity and production in Ontario were virtually static during this period, but they have begun to increase as the results of publicly assisted modernization expenditures come on stream. In contrast to newsprint, Ontario's kraft pulp capacity has expanded quite quickly in recent years—by about 80 per cent from 1970 to 1980 (Ontario 1981, 16). Most of Ontario's pulp exports move to midwestern and northeastern American markets just as newsprint does. While U.S. newsprint consumption increased by about 14 per cent during the 1970s, U.S. woodpulp consumption rose by 23 per cent. The stronger consumption trend for woodpulp, combined with increased market shares for Ontario producers in northeastern and midwestern U.S. markets, permitted the absorption of the province's large capacity increases in the 1970s.

Notwithstanding Ontario's ability to maintain market share in its newsprint export markets and a creditable increase in pulp production, the industry has become increasingly concerned about costs of production in Ontario relative to the southern U.S. Concern has centred on relative labour costs, relative costs of access to wood, transportation costs on Canadian pulp and paper shipments to the U.S., the relative impacts of the two countries' corporate taxation systems on investment behaviour, and the relatively low productivity of older eastern Canadian newsprint mills. The present study has been undertaken with the explicit intention of dealing with the impacts of these variables (and others) on the present and future viability of Ontario's newsprint and kraft pulp manufacturing sectors. In 1979, the Government of Canada and several provincial governments announced a major program of public assistance to the pulp and paper industry in the form of modernization grants, directed principally to the newsprint sector in eastern Canada. Ontario producers received a significant share of these grants

before the program ended in 1984. Our examination of relative costs and profitability in Canada and the U.S. allows us to examine the need for public assistance of this kind in one of Ontario's leading manufacturing industries.

In addition to the question of relative production costs and tax treatments, the pulp and paper industry is becoming increasingly aware of a second major issue influencing its prospects for the future: the question of whether available timber supplies are sufficient to support existing mills and to provide fibre for further expansion. While our own research efforts in this study are not directed to supplying additional information about the adequacy of Ontario's forest resource base, our conclusions will be shaped by the results of recent work that indicates that the limits of sustained timber supply in the province have now been reached (Reed 1978 and 1980; Ontario 1981, ch. 4).

In principle, wood supply constraints should be translatable into cost information. Economic theory predicts that shortages of pulpwood will lead to rising pulpwood prices and rising wood costs in pulp and paper. In practice, the cost analysis is largely independent of timber supply constraints because of the absence of market forces in the allocation of Ontario's timber supplies to processors. A forestry map of northern Ontario shows company- and Crown-managed areas (management units) within which timber supplies are 'spoken for' through long-term wood supply arrangements (Order-in-Council cutting licences, for the most part) that preclude competition. Prices attached to units of the resource in the form of standing timber—referred to as stumpage prices—are not determined by supply and demand but are set by the Ontario Ministry of Natural Resources as administered charges indexed to product selling prices. The result is that timber scarcity makes itself felt as a direct physical constraint on the industry: as the limits of the resource press on manufacturing capacity, new mills and expansions of old mills become infeasible, since the Ministry of Natural Resources cannot assign additional timber supplies to permit expansion to proceed. Now that the limits of wood supply in the province have been reached, it is even possible that some existing mills will be forced to reduce their operating rates.

Recognition of the resource-base constraint in a study of the province's relative competitive position could produce either of two broad sets of results. The first possible case is that expansion of the industry (measured in terms of wood fibre use) cannot occur because of timber scarcity *and* because the industry's competitive cost position is unfavourable, so that expansion is not desired. In this case, doubts emerge concerning prospects for the long-term survival of operations now in existence. The second case also recognizes the resource-base constraint but finds that the industry's competitive cost position is favourable, so that further expansion of the province's capacity would be economic if wood supplies were available. In this case, the long-run survival of existing mills is relatively secure,

though continued increases in the capital–labour rates as modernization proceeds is likely to reduce long-term employment opportunities, given the limitation on total output set by the timber constraint.

It is not giving too much away at this stage to say that the results of this study favour the second case rather than the first. While the resource constraint (to which we return in Chapter 6) largely precludes further capacity expansion in northern Ontario, fully modern newsprint and kraft pulp mills in this region should prove economically viable in the production of products competing with U.S. products in our traditional American export markets. This conclusion, in turn, implies that public assistance to capital spending in the industry is not required to secure its long-run survival under presently foreseeable conditions, even if the survival of this particular industry were to be advocated as a public policy goal.

METHODOLOGY AND PLAN OF THE STUDY

Any examination of relative regional production costs in an industry, or collection of industries, ultimately seeks to compare the relative profitability of existing or potential operations in the different locations being considered. At the same time, one may want to compare profitability in a specific location with the minimum profit needed to operate existing plants or to justify expanding capital investment in the region's facilities. One approach to the problem is to simply compare relative wages, transportation costs to existing markets, relative materials costs, and so on, with a view to giving a general indication of which inputs are more or less expensive to acquire in different locations. This was the strategy adopted by Wonnacott and Wonnacott (1967). A more comprehensive approach involves weighting the inputs to produce a single unit cost measure (including transportation) that can be compared by location. A good example of this approach is the analysis of overall relative manufacturing costs in Nova Scotia and central Canada conducted by George (1970). Once a unit cost measure is in place, a unit profit figure can be obtained if product prices are known. This step, in turn, makes it possible to put further questions to the data: for example, is the product price high enough to cover unit *variable* cost at a particular location, so that plant shutdowns will not occur in the short run? If plants achieve short-run viability, are product prices high enough to extend viability into the long run, which requires that revenue cover not only variable costs but capital costs as well? How high is the return on capital in the industry and how does the return vary by location?

This study will go beyond comparisons of regional relative costs or unit cost measures and beyond questions of short-run viability. We shall use cost measures

as informational inputs to examine *rates of return* on pulp and paper investments in alternative locations. Three regions enter the comparisons: northern Ontario, Quebec, and the southeastern United States.

For each region, we calculate expected before-tax and after-tax internal rates of return (IRORs) on capital expenditures in new manufacturing facilities for newsprint and kraft pulp, given existing factor costs (including transportation) and tax systems appropriate to the region.

Before we set out the analytical framework, a few comments on the IROR approach to profitability are in order. We have selected this measure on theoretical grounds. A widely used alternative measure is the accounting rate of return, expressed as the ratio of (average) profit over an investment horizon to the (average) depreciated value of the investment itself. In a recent article, Fisher and McGowan point out that the IROR (or economic return) 'is the only correct measure of the profit rate for purposes of economic analysis. Accounting rates of return are useful only insofar as they yield information as to economic rates of return' (1983, 82). In fact, accounting rates of return do not reproduce IRORs except under assumptions about depreciation that are designed specifically for this end and that differ from both normal accounting approaches to depreciation and depreciation calculations for tax purposes (capital consumption allowances). When projects are interdependent and/or vary in size, with overall budget constraints influencing project selection, selection of projects in order of their IRORs can be hazardous, since present value maximization can lead to different, and preferred, results. IROR analysis assumes that project IRORs are unique. The projects considered here are of approximately equal size, are not interdependent across regions, are not being examined subject to budget constraints, and experience only one sign reversal (negative to positive) in their net revenue streams. These conditions ensure that IROR analysis subject to a required rate of return produces the same set of decisions as present value analysis, in which projects are selected on the basis of positive net present value, using the required rate of return as the discount rate. It should be pointed out that IROR and net present value approaches to capital decisions are becoming the norm in the pulp and paper industry (Garceau, Papineau, and Schreiber 1979).

Our analysis requires calculation of existing and projected before-tax operating costs and revenues in the three regions together with capital costs involved in constructing new manufacturing plants.[4] The following four equations, which are discussed in greater detail in Chapter 5, are presented here with an abbreviated discussion to acquaint the reader with the basic profitability framework of the study. We calculate a before-tax internal rate of return on projects using the formula

$$K_0 = \sum_{t=0}^{40} \frac{[S_t - C_0(1+\delta)^t]}{(1+r)^t}, \qquad (1)$$

where K_0 is the initial capital expenditure, S_t is operating revenue in year t at base year prices, C_0 is initial operating cost, δ is the assumed rate of increase of operating cost at base year prices owing to rising real wages (and possibly real wood costs), and r is the real pre-tax IROR. As equation 1 indicates, the assumed time horizon is forty years, a duration long enough to reduce the present value of any subsequent net revenues to a negligible size.

When corporate taxes are introduced, equation 1 is modified to allow for the fraction of net income taken in taxes as well as capital consumption allowances and investment tax credits (see Chapter 4 for a detailed discussion). The real after-tax IROR (r^*) is then calculated using the formula

$$K_0 = \sum_{t=0}^{40} \frac{(1-T)\,[S_t - C_0(1+\delta)^t] + T \cdot D_t + Z_t}{(1+r^*)^t}, \qquad (2)$$

where, in addition to the symbols defined above, T is the nominal corporate tax rate in the region, D_t is the capital consumption allowance at time t and Z is the investment tax credit claimed at time t.

Equations 1 and 2 allow interregional differences in both input costs and tax systems to enter into the analysis of profitability. Internal rates of return in northern Ontario can be compared with IRORs in Quebec and the southeastern U.S. on both a before-tax and an after-tax basis, an exercize that separates the regional effects of the different tax systems from the regional effects of variations in input costs.

Such an examination of after-tax pulp and paper IRORs across regions is essentially a test for short-run disequilibrium in the interregional allocation of capital in the industry. For example, if industry after-tax IRORs in region A exceed those in region B and capital is mobile in the long run, it is a reasonable hypothesis that region A will attract investments more readily than region B and will therefore grow more rapidly until changes in relative regional input prices or in tax–subsidy treatments close the gap between the after-tax IRORs in the two regions. This disequilibrium adjustment process does not mean that region B will decline over time, but only that its market *share* will tend to decline relative to region A's share. If, however, region B's after-tax IROR is not only lower than region A's but also less than the return on capital in general, region B's relative decline may be converted into *absolute* decline as capital migrates out of pulp and paper in region B to other industries or to pulp and paper investments in other regions.

However, predictions of the direction of disequilibrium adjustments based on relative IRORs have to be used with caution. The operating costs and revenues that form the basis of IROR calculations must be extrapolated from currently observed operating costs and revenues, and there are occasions when extrapolation can be misleading. One such occasion arose in the mid-1970s, when the over-valued Canadian dollar had substantially reduced operating revenues for pulp and paper producers in Canada. An IROR analysis that projected these reduced revenues over a forty-year investment horizon on the basis of the existing exchange rate would have ignored the strong likelihood of exchange rate depreciation, which in fact took place in 1977-78. Such an analysis would have produced the conclusion that long-term investments in Canadian mills could not be justified either relative to U.S. locations or relative to opportunities outside pulp and paper. In fact, as we shall show later, reasoning along just this line was the major impetus behind the federal–provincial capital subsidies that the industry received between 1979 and 1984. As soon as the value of the Canadian dollar declined, after-tax IRORs in Canadian regions rose appreciably, to levels that more accurately reflected our fundamental (long-run) competitive relationship with U.S. pulp-and-paper-producing locations.

In addition to using the IROR framework to make the interregional profitability comparisons that form the core of the study, we also use it to explore some specific issues concerning the sensitivity of investment profitability to changes in the Canadian–American exchange rate and the impact of alternative assumed rates of inflation on real before-tax and after-tax rates of return in North America (see also Anderson, Beaudreau, and Bonsor 1983).

Examination of each of these issues—exchange rates, inflation, and investment incentives—requires modest changes in equations 1 and 2. In order to examine exchange rate changes, we alter the revenue stream (S_t) in the Canadian locations to reflect assumed variations in the U.S. dollar price of Canadian currency. Investment incentives involve changes in the capital costs of new facilities to the private sector (K_o). The impact of alternative rates of anticipated inflation on internal rates of return requires equation 1 to be rewritten as

$$K_0 = \sum_{t=0}^{40} \frac{[S_t - C_0(1+\delta)^t](1+p)^t}{(1+r')^t}, \tag{3}$$

where p is the fully anticipated rate of inflation in product and input prices and r' is the associated nominal IROR. In this before-tax case, the real IROR in equation 1, denoted by r, is linked to the IROR of equation 3, denoted by r', by the definitional relationship $r = [(1 + r')/(1 + p)] - 1$. With inflation, equation 2 is now written as

$$K_0 = \sum_{t=0}^{40} \frac{(1-T)\,[S_t - C_0(1+\delta)^t]\,(1+p)^t + T{\cdot}D_t + Z_t}{(1+r_p)^t}, \qquad (4)$$

where r_p is the nominal after-tax IROR in the presence of the fully anticipated inflation rate p. Since the terms $T{\cdot}D_t$ and Z_t are not indexed to the rate of inflation, the definitional relationship between real and nominal IRORs in equations 1 and 3 is not preserved. The real IROR from equation 4 is $\hat{r} = [(1 + rp)/(1 + p)] - 1 < r^*$ (where, as before, r^* is the real after-tax IROR). Failure to index capital consumption allowances is mainly responsible for the sensitivity of real after-tax IRORs in Canada and the United States to different anticipated inflation rates. The degree of sensitivity depends on the specifics of the corporate tax systems in both countries.

The remainder of this chapter outlines the plan of the study. *Chapter 2* begins by describing the relationship between the pulp and paper industry and government representatives during the 1970s and 1980s. This relationship was shaped by fears that the industry was not going to be able to compete successfully with firms in the United States in the 1980s. A 'crisis atmosphere' developed in which the industry pressured Canadian governments—federal and provincial—to 'do something'. The 'something' that they did was the Pulp and Paper Modernization Program, a system of capital grants for modernization purposes that subsidized investment and yet failed to provide an appropriate framework for establishing the need for such subsidies. At the end of Chapter 2 we suggest such a framework—one that allows us to use the four equations described briefly in the present chapter, and in more detail in Chapter 5, to make absolute and relative (interregional) profitability judgements.

Chapter 3 begins the nuts and bolts task of assembling the data required for our interregional project comparisons. Most of this chapter is devoted to a comprehensive comparative analysis of 1982 newsprint and kraft pulp manufacturing costs in Ontario, Quebec, and the southeastern United States. In addition to reporting operating and transportation costs, this chapter also reports estimates of the capital costs involved in constructing new (greenfield) newsprint and pulp mills in these three regions in 1982.

Chapter 4 describes the corporate tax systems that have to be used to convert before-tax profitability comparisons to after-tax comparisons. Like Chapter 3, this chapter sets the stage for the internal rate of return calculations and sensitivity results that follow. So many of our results involve the relative impacts of the Canadian and U.S. tax systems on manufacturing in general—and pulp and paper in particular—that we feel it is important to set out the tax systems in some detail before we describe our theoretical and empirical work.

The results in *Chapter 5* represent the core of the study. The first section of Chapter 5 sets out the IROR framework summarized in equations 1 through 4 and reports the main results of using these equations to produce before-tax and after-tax IRORs for greenfield pulp and paper projects in Ontario, Quebec, and the southeastern U.S. These results appear in Tables 5.1 through 5.6. Subsequent sections of Chapter 5 use the information in these tables to examine the major questions addressed in this study. First, how do differences in regional costs and tax systems actually influence expected IRORs in the various regions? Second, how sensitive are Canadian expected IRORs to fluctuations in the value of the Canadian dollar? Third, what effects do the Canadian and U.S. tax systems have on new firms seeking entry to the pulp and paper industry or other manufacturing sectors and how do inflationary trends influence after-tax rates of return expected on new investments? Finally, is there evidence that after-tax IRORs on new investments in the Canadian pulp and paper industry are too low to attract capital, given the returns available in other sectors and locations? And a closely related question: were the modernization grants provided to the industry by the federal and provincial governments actually necessary to its investment plans in the 1970s and early 1980s?

The policy implications that emerge from our empirical results are taken up in *Chapter 6*. We find that Canada's corporate tax structure discriminates heavily against new firms and against investment in structures. The adverse effects of anticipated inflation on real rates of return do not appear to produce serious problems in Canada. We also find that the Canadian corporate tax system has been subject to too many arbitrary changes. The fact that rates of return on new investments in Ontario's pulp and paper sector (Chapter 5) are generally favourable obviously calls the Pulp and Paper Modernization Program into question. We argue in this chapter that such grants are not only unnecessary to the achievement of profitable private investment results but objectionable on wider theoretical grounds. Nor have they been as popular with members of the pulp and paper industry as one might suppose. Despite favourable profit opportunities, growth potential for the pulp and paper industry in Ontario is limited by resource constraints as the province approaches the limits of its timber supplies. Whatever the corporate tax structure or capital grants framework, policymakers must realize that pulp and paper cannot provide a stream of new jobs for the future. Because of the resource constraint, it is more likely that some existing jobs will be lost as modernization proceeds.

Chapter 7 summarizes the conclusions and recommendations of the study.

NOTES

1 The statistics in this paragraph refer to 1980 figures in Statistics Canada: *Manufacturing Industries of Canada: National and Provincial Areas* (31-203).
2 *Dried pulp* refers to pulp manufactured at the mill and subsequently shipped to other mills, either on an arm's-length basis or to affiliated operations of the same company. Pulp entering into arms-length sales is referred to as *market pulp*.
3 Miscellaneous products include linerboard, corrugating medium, tissue paper, and building materials, to mention only the most important products.
4 For further discussion, see Anderson, Beaudreau, and Bonsor (1983).

2
Industrial Incentives in the Pulp and Paper Industry: Theory and Policy

THE CRISIS ATMOSPHERE OF THE 1970s

Projections of the competitive position of eastern Canada's pulp and paper industry are almost inevitably influenced by the industry's experience over the past decade or so, and especially by the events that led up to the federal–provincial capital grants policy instituted in 1979. Apart from the depression of the 1930s and the 1981–82 recession, the mid-1970s was the most difficult period ever faced by Canadian pulp and paper firms.

Between 1971 and 1976, prices in Canada (measured in terms of the GNE deflator) rose at about 10 per cent annually, while in the United States the inflation rate was about 7 per cent (Lipsey, Sparks, and Steiner 1982; Barber and McCallum 1980). Yet the Canadian dollar remained approximately at par with the U.S. dollar over this period. Consequently, given purchasing power parity in 1971, the Canadian dollar was overvalued by at least 15 per cent by the end of 1976. On the basis of par values, average hourly earnings in Canadian and U.S. pulp and paper mills were approximately equal in 1971, but by 1976 Canadian hourly earnings were 25 per cent higher than earnings in U.S. mills. Increases in labour costs at Canadian mills were especially noticeable in the newsprint sector, where mills were considerably older than mills in the United States and production required more manhours per ton of newsprint—in some cases more than twice the labour input of mills in the southern states (Ontario 1981, 87ff.). The Canadian industry communicated its concern about its competitive cost position, given the Canadian dollar at par, to federal and provincial government officials. The industry argued that while modernization of pulp and paper facilities, particularly in the newsprint sector, was essential to the reduction of mill labour costs, modernization investments were unlikely to earn adequate rates of return.

This conclusion was based on an extrapolation of mid-1970s operating costs and revenues in Canadian dollars.

Studies undertaken by the federal Department of Industry, Trade and Commerce quantified the high operating cost positions of Canadian pulp and paper producers, particularly in eastern Canada, relative to American firms (Sandwell 1977; Peat, Marwick and Partners 1977).[1] Similar cost disadvantages were reported by pulp and paper companies to the Quebec Standing Committee on Natural Resources and Lands and Forests in the fall of 1977.

The Quebec Standing Committee testimony identified a difference of $50 to $60 per short ton between production costs for newsprint in Quebec *and* costs in competing locations in the southern U.S., given the Canadian dollar at par. Though the cost differences identified in the 1977 Sandwell study were somewhat smaller, a cost analysis undertaken three years later for the Ontario Royal Commission on the Northern Environment confirmed that Quebec newsprint operating costs would have been higher than costs in the southern U.S. by about $60 per short ton had the Canadian dollar been at par in 1980 (Ontario 1981, ch. 3). On the same basis, 1980 newsprint production costs in Ontario exceeded costs in the U.S. by about $85 per short ton. In percentage terms, Quebec operating costs were about 25 per cent higher than costs in the U.S., and Ontario costs were about 35 per cent higher.

Apart from long-standing differences in wood costs and transportation cost disadvantages borne by Canadian mills selling into markets in the northeastern and midwestern U.S. (see Chapter 3), the major reason for these cost differences was *the overvalued Canadian dollar*. Net capital inflows buoyed up the exchange rate until 1977, when rapid depreciation began. As long as the Canadian dollar remained at par, Canadian operating costs were too high. At the same time, poor profitability in the Canadian industry made for pessimism concerning long-term rates of return on modernization investments crucial to the reduction of operating costs at older newsprint mills. The companies also argued that the Canadian corporate tax system was more onerous than the U.S. system.

In this negative atmosphere, pulp and paper companies and their spokesmen at the Canadian Pulp and Paper Association (CPPA) began to seek government assistance. Specific requests for two types of assistance emerged by 1977. Representatives of companies operating older newsprint mills in eastern Canada stressed the high level of capital spending needed to both modernize their plants and equip them to meet pollution control requirements; they saw *capital grants* from governments as a way to finance these specific requirements. The CPPA sought *tax relief* for the Canadian industry as a whole. In early 1978, the CPPA submitted a specific proposal to the federal government a 'forest products industry investment allowance':

> ...for each two dollars spent on investments in qualifying projects there would be an allowance of one dollar. Companies would be permitted to deduct these allowances from income, and the maximum allowance in any one year would be one-third of income in that year. Unused allowances would be available for carry-forward. (CPPA 1978,5)

The CPPA stressed that this new investment allowance would be additional to investment tax credits available to Canadian manufacturing in general (see Chapter 4) and that such incentives would be easy to adminster and non-discriminatory across companies in the pulp and paper industry.

Despite the CPPA's stated preference for tax relief, public policy was moving away from this option in 1978. The companies and the CPPA had made an effective case for some form of assistance before the Quebec Standing Committee in 1977 and, as a result, the Quebec Minister of Lands and Forests announced a major program involving mill modernization and forestry improvements in mid-1978. The Quebec plan involved capital grants on a firm-specific basis. In June 1978, the federal Department of Industry, Trade and Commerce released an industry task force analysis of pulp and paper's competitive position (Canada 1978) based largely on the consulting studies mentioned above (Sandwell 1977; Peat, Marwick and Partners 1977). In November 1978, the Ontario government brought out its own report in which the authors stated that they were 'convinced that the required investment will not occur and that the industry will fall further behind, in the absence of powerful incentives' (Ontario 1978, 1).

Both the federal task force report and Ontario's report contained specific proposals to assist the industry. Influenced in part by the CPPA approach, the task force report focused on the tax system as a method of improving the industry's competitive position. To justify tax relief, the report argued that 'forest products companies in Canada are still operating at a significant tax disadvantage in relation to integrated forest products companies in the United States' (Canada 1978, 5).[2] In fact, rapid (two-year) capital consumption provisions had already been introduced for manufacturing capital investments in 1972 and an investment tax credit had been introduced in 1975. The latter provision was liberalized in 1978. The federal government responded to the task force's view that Canadian companies were at a 'significant tax disadvantage' with a rejoinder that stressed these new provisions (Canada 1979).

Convinced of the need for assistance all the same, the federal task force had as its principle recommendation higher levels for investment tax credits in general. The Ontario report echoed the tax relief recommendations of the federal task force and, with one eye on events in Quebec, also recommended that Ontario initiate a five-year capital grants program to assist the industry.

In the meantime, changes were occuring not only on the policy front but in the

foreign exchange markets as well. By the end of 1978, the Canadian dollar had dropped below $.90 U.S. Industry representatives, having built up momentum in favour of assistance to the industry at both the federal and provincial levels of government, were anxious not to lose the fruits of their efforts. The 1978 task force report referred to the comparative Canadian–American cost analysis done by the Department of Industry, Trade and Commerce as follows: 'Changing economic circumstances, especially the fall of the Canadian dollar, have altered some of the relationships described in that analysis. But the more deep-rooted competitive difficulties of Canadian industry will not be solved, though they may be eased, by exchange rates' (ibid., 2).

In fact, exchange rate depreciation was changing everything. A lower value for the Canadian dollar in line with the relative changes in Canadian and American price levels between 1971 and 1976 had two effects. First, it compensated for higher wage levels in Canada relative to the U.S. Second, it increased (expected) rates of return on modernization investments so that high-cost mills could be renovated and partially replaced to bring their productivity into line with best-practice technology. The sensitivity of profits and rates of return in the pulp and paper industry is very marked, as we shall show in Chapter 5. Had the effect of the fall in the value of the Canadian dollar in 1977 and 1978 been incorporated into the comparative cost analysis, it would have virtually eliminated the industry's case for public sector assistance. But the policy momentum of the earlier period was too strong. Reassessments were not undertaken.

THE PULP AND PAPER MODERNIZATION PROGRAM

Responding to the crisis atmosphere of the mid-1970s, the Government of Canada announced, in February 1979, a $235 million capital grants program aimed at assisting the pulp and paper industry. Agreements signed with the governments of Quebec and Ontario in May 1979 linked federal assistance with provincial funding. In Ontario, the industry was to receive $150 million in the modernization grants over the period 1979–84: $50 million from the Department of Regional Economic Expansion and $100 million from the province. The Quebec industry was also to receive $150 million, but in this case $90 million would come from DREE and $60 million from the province. The remaining $95 million of the $235 million federal commitment was earmarked for the Atlantic Provinces and western Canada, subject to similar cost-sharing agreements with the provinces concerned.

As it turned out, the western provinces (Alberta and British Columbia) did not enter the capital subsidies program. New Brunswick entered the program in 1980, and Newfoundland and Nova Scotia entered it in 1981. The Ontario and Quebec

programs were expanded in 1980, raising the *total* federal commitment to $276 million dollars. Ontario companies were to receive $60 million from DREE and $120 million from the province. Quebec mills would receive $135 million from DREE and $105 million from the province.

The modernization program was the direct result of the industry representations and government studies described in the previous section. Industry reaction to the program was mixed. Many companies had, of course, been in favour of some form of capital grants. Others had been much more strongly in favour of the tax relief option put forward by the CPPA. Firms that had previously renovated their facilities entirely with private funds resented the application of public money to firms that had delayed making such expenditures.

The grants program was very large, and no doubt the government departments involved found it difficult to administer. The federal share of the program, set at $276 million over five years, implied average annual outlays of $55-60 million, with most of the administration decisions bunched in 1979 and 1980. An outlay of $55-60 million per year was equal to about half of DREE's incentive payments under the RDIA legislation for the early 1980s. Apparently DREE expected much of the work of determining individual company grants to be undertaken at the provincial level. The department commented that offers of assistance in Quebec were 'slow in starting as provincial officials initiated project evaluation procedures with which they were largely unfamiliar' (Canada 1980b,5). Ontario pulp and paper companies were quick to respond to the capital incentives: by April 1980, six of the nine integrated companies in the province had accepted grants amounting to $140 million, or about 80 per cent of the total federal and provincial funds allocated to Ontario. By the end of 1983, federal and provincial grants to Ontario pulp and paper companies totalled $188 million. The grants ranged from 6 to 14 per cent of project cost, with an average of about 9.5 per cent of project cost.

The project evaluation procedures used by DREE and by the provinces have never been made public. Some misgivings developed within DREE in 1980–81. Commenting on grants in Quebec, DREE admitted that 'there are concerns that incrementality has not always been observed, and that levels of assistance have tended to be approved in the range of 20% to 25% of eligible assets in instances where lesser grants may have sufficied to achieve the necessary incentive' (ibid., 7). In the winter of 1981, *after most of the grants had already been agreed upon*, the deputy minister of DREE, R.C. Montrevil, indicated that further evaluation remained to be done and

> if we find there has been an insufficient amount of incrementality (modernized mills, significant private investment compared to previous periods etc.) government financial

support may be directed elsewhere. (Quoted in *Pulp and Paper Canada*, March 1981, 16)

Officials at DREE and at the provincial ministries must have realized by mid-1980 that competitive circumstances in the industry had changed drastically. Although the Canadian dollar had been below $.90 U.S. since early 1978 and Canadian operating rates and profits had surged to high levels in 1979 and 1980, government officials associated with the modernization programs apparently refused to integrate this new information into their evaluations. Some baffling remarks resulted. A 1980 DREE discussion of the Quebec program commented on Quebec's case as follows:

> The fundamental problem facing the Quebec pulp and paper industry is the decline of its competitive capacity.... This situation, characterized by the devaluation [*sic*] of the Canadian dollar and an exceptional increase in the demand for newsprint, makes for a number of basic problems: prohibitive wood-supply costs, low productivity of mills and high cost of transporting finished products. (Canada 1980a, 92)

How the competitive problems of an export industry could be 'characterized' by a depreciated domestic currency is not explained.

It is evident from the preceding discussion that the evaluation procedures employed in the modernization program left a great deal to be desired, though again the actual procedures followed by government officials in assessing firms' 'needs' for modernization grants have not been made public. Even some of the officials involved in the process expressed misgivings, as we have noted.

ESTABLISHING A PROJECT EVALUATION FRAMEWORK

Capital expenditures supported by the federal-provincial modernization program almost invariably involved the updating of *existing* pulp and paper mills in order to help them to reduce their operating costs, meet clean air and water requirements, or both. Each project given such support derived its specifications from the particular mill to which it applied. The present study does not examine capital expenditures of this sort. Instead it focuses on standardized projects that involve the construction of entirely new (greenfield) capacity in newsprint and kraft pulp.

Given the predominance of modernization investment in Canada's pulp and paper sectors, how revelant are interregional rate of return (IROR) comparisons that focus on greenfield capital expenditures? It is possible to argue that rates of return on greenfield newsprint and sulphate pulp mills are merely hypothetical and bear little relation to the rates of return that firms actually confront when they plan projects in the context of their existing (sunk) capacities.

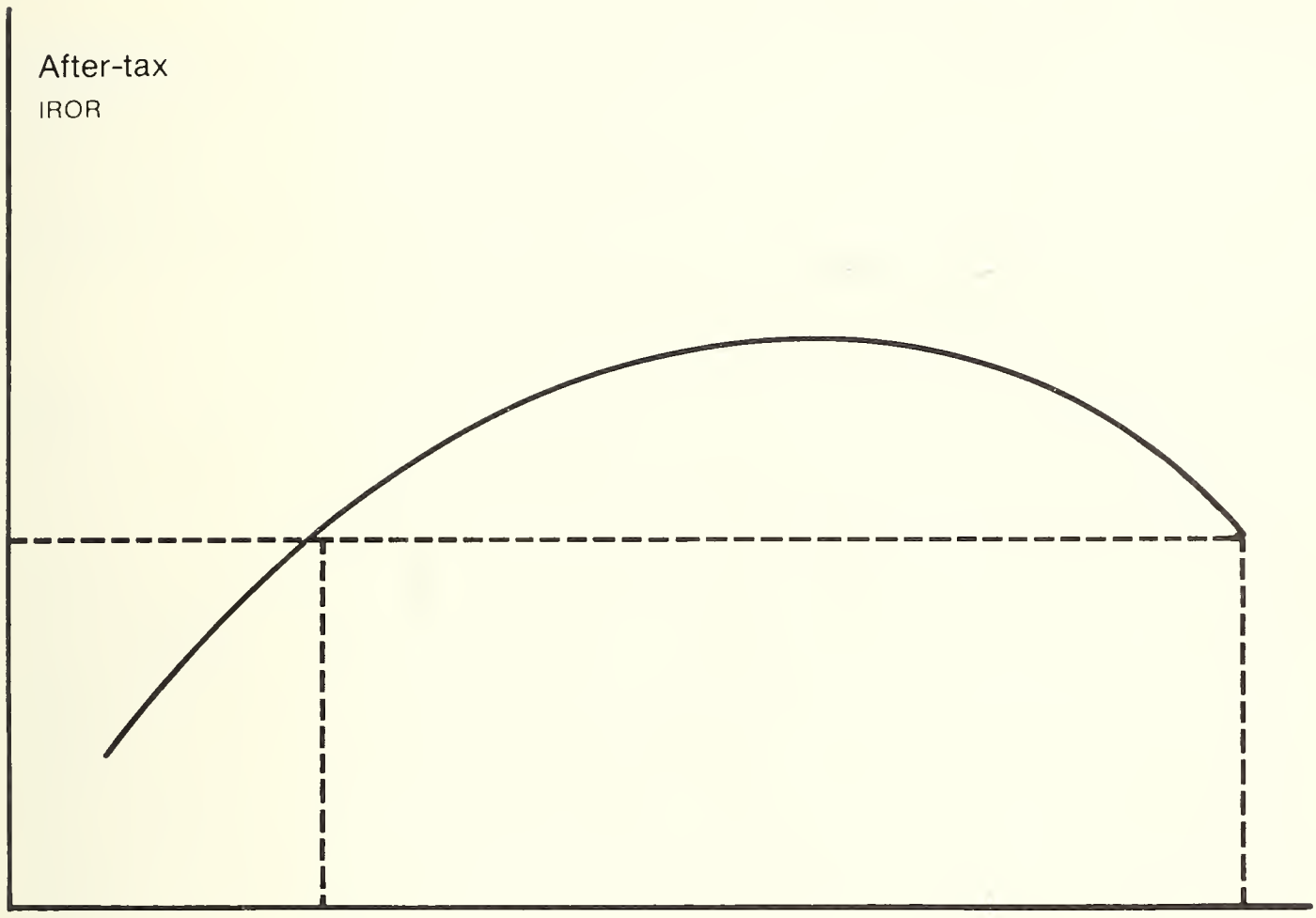
Our response—an entirely practical one—is that rates of return on modernization projects vary too much from mill to mill and from region to region to permit valid comparisons. IRORs on new investment in existing facilities depend in part on sunk costs. Sunk costs vary from location to location, reflecting differences in historical patterns of capital expenditure, and comparisons between regional IRORs on modernization expenditures must reflect these differences as well. Even if it were possible to make valid comparisons, it would be prohibitively difficult to obtain the necessary firm-specific cost and revenue information, much of which is confidential.

These difficulties are largely overcome when greenfield projects are examined. Greenfield companisons, by assigning zero values to existing investments, remove the influence of historical decisions and thus make it possible to isolate the long-run impact of differing costs and tax systems on location decisions. Moreover, entirely new projects appear with enough frequency and are described in the trade literature in enough detail to make the task of constructing interregional comparable costs a relatively simple one. Greenfield projects provide an *index* of project profitability that is accessible to all firms in the industry and to outside researchers as well.

Examination of greenfield projects is an important exercise even if modernization of existing facilities is the chosen avenue for capital expenditure. In this case, the after-tax IRORs on greenfield projects provide a check on rates of return on modernization. For example, if after-tax rates of return on new mills in northern Ontario are high enough to meet the economy-wide opportunity cost of capital, and if firms assert that modernization of existing plants is a better option than greenfield investment, then it can be inferred that the modernization projects *also* meet the economy-wide cost of capital. It is particularly important to be able to draw inferences of this kind when industry representatives argue, as they did in the late 1970s, that rates of return on investment are too low to attract capital to pulp and paper manufacturing locations in northern Ontario (and eastern Canada in general).

Figure 2.1 illustrates the likely relationship between after-tax IROR and the scale of investment activity in a particular location with pre-existing facilities. Each project scale is mutually exclusive and is assumed to possess a unique IROR. At low levels of capital expenditure, the after-tax IROR rises with increasing project size, either because of indivisibilities or because initial expenditures have to be made on improvements with low private returns (e.g., mandatory pollution abatement).[3] Since there are cost advantages to integrating *some* of the sunk capital into a modern facility, the IROR reaches a peak in Figure 2.1 at a scale of investment less than the scale corresponding to a completely new (greenfield) manufacturing operation at point B.

FIGURE 2.1



Expenditures to the left of point A in Figure 2.1 promise IRORs less than the IROR that would be achieved by a greenfield project. Modernization in this range is inefficient relative to an entirely new plant, owing to the small scale and/or the characteristics of the capital expenditures that have to be made assuming that the investor does not face a budget constraint. Between points A and B, modernization is an efficient alternative to the greenfield project at B. If the after-tax IROR at point B exceeds the opportunity cost of capital, then modernization projects over the range from A to B also promise IRORs that exceed the cost of capital. Small-scale projects to the left of A may not meet capital costs, particularly if they incorporate expenditures that reflect mandatory environmental outlays. However, provided that required environmental outlays *are* included in the calculation of IRORs to the right of point A, the fact that such outlays offer low (or negative) returns on their own does not mean that they cannot be included in larger projects that meet the opportunity cost of capital. The capital costs estimated for new projects in the next chapter include outlays necessary to meet present environmental standards in Canada and the U.S.

To summarize the discussion of this section:

1. The sunk capital that lurks behind modernization projects means that interregional comparisons of returns on such projects incorporate differences that are not due simply to interregional differences in factor prices and tax systems. Comparison of greenfield projects eliminates this comparability problem and reveals the underlying effects of factor prices and taxes on strategic location decisions.

2. The difficulty of acquiring accurate information on plant-specific cost and revenue streams makes interregional comparisons of modernization projects impractical.

3. Evaluation of greenfield projects that meet society's environmental requirements sets a standard against which other projects can be examined. As Figure 2.1 demonstrates, some small projects may not meet the IRORs offered by larger projects. The IRORs on larger projects, in turn, may be comparable to the IRORs on complete replacement of existing capacity by an entirely new pulpmill or newsprint mill. If the latter approach meets the cost of capital, then the fact that small projects do not meet the cost of capital implies, not that investment is uneconomic, but that larger projects have to be contemplated. This does not mean that one moves automatically to point B (the new project). Given sunk capital, higher returns may be available in the range between points A and B.

The general characteristics of our IROR methodology were described in the previous chapter (equations 1 to 4). The outcome of the present discussion is that the capital costs used in our IROR calculations (K_0 in the equations) in Chapter 5 are the costs of constructing completely new mills in the three North American regions examined. Consequently the calculated after-tax IRORs measure the relative profitability of greenfield mills and do not imply that any pair of modernization projects in two of the regions would have the IROR ranking of greenfield projects in the same locations. Finally, our comparisons of the hurdle cost of capital with pulp and paper IRORs in Ontario always refer to new newsprint and pulp mills, not modernization projects; at any given location, IRORs on the latter may exceed IRORs on new mills, as discussed above.

NOTES

1 The Sandwell results, along with earlier cost comparisons, are described in Chapter 3.
2 The federal government subsequently dissociated itself from the report and published a reply listing areas of agreement and disagreement (Canada 1979).
3 The question of whether or not required pollution abatement expeditures in the Canadian pulp and paper industry would place domestic firms at a significant competitive disadvantage relative to U.S. pulp and paper firms was examined by Muller (1976) and Fortin (1980). These studies concluded that the effects were minor.

3
Production Costs

The long-run viability of the pulp and paper industry in Ontario depends on the ability of producers to lay down output in export markets at prices that cover long-run average costs. Traditionally, the bulk of Ontario production has been exported to U.S. markets, the most important of which are in the northeastern and midwestern states. In recent years, Ontario producers have faced increased competition in these important markets from producers in the southern U.S. and Quebec.

Since the 1970s, Ontario producers have consistently asserted that the cost of producing newsprint and kraft pulp is considerably lower in the southern U.S. and somewhat lower in Quebec. In consequence, Ontario producers have claimed, the viability of the industry in Ontario is seriously threatened.

A clear distinction must be made between short-run and long-run viability. In the short run, production from existing facilities will occur as long as market price is equal to or greater than average short-run variable costs. Thus the viability of the industry in the short run requires only that existing producers cover variable production costs. In the long run, viability of the industry in Ontario requires that market price be sufficient to cover long-run average production costs. The long-run viability of an Ontario location is independent of the viability of existing production facilities: the relevant question is whether an Ontario location, given factor prices and available technology, can yield an efficient producer a required rate of return on capital. In line with the discussion in Chapter 2, the least ambiguous approach to the question of long-run viability is to analyze rates of return to investments in new (greenfield) facilities in each of the three regions.

The major aims of this chapter are, first, to present data on the cost of producing newsprint and kraft pulp in Ontario, Quebec, and the southern U.S. for the period 1960–80 and, second, to derive a set of cost estimates for the production of newsprint and kraft pulp in the three regions in 1982, given state-of-the-art greenfield facilities.

PRODUCTION COSTS: 1960–80

Although it is not possible to derive a detailed set of data for production costs in the three regions, sufficient information exists to permit a meaningful comparison of cost trends for the period 1960–80.

Table 3.1 presents data on the cost of producing newsprint at different points in time in the three regions in new (greenfield) facilities. All costs are given in Canadian dollars and exclude capital costs and transportation costs. It can be seen that for the years for which data are available the average variable costs of production in Ontario and the southern U.S. were not significantly different and that, based on 1980 costs, a Quebec location enjoyed a cost advantage.

Table 3.1 masks a number of important points. First, the addition of transportation costs for the shipment of the final product would increase the costs given for Ontario and Quebec relative to those given for the southern U.S. The data for 1980 indicate that Ontario and Quebec producers faced transportation costs that were approximately $10 Canadian higher than those faced by producers in the southern U.S. Second, the average variable costs given in Table 3.1 reflect the then-current exchange rate. There is considerable evidence that during the period 1971–77 the Canadian dollar was overvalued relative to the U.S. dollar (see, for example, Lipsey, Sparks, and Steiner 1982 and Barber and McCallum 1980). From 1971 to 1977, therefore, production costs in Ontario, when adjusted for exchange rates were substantially higher than costs in the southern U.S.

Adequate data for the cost of producing newsprint in (then) existing facilities is available for only two years: 1976 and 1980. Excluding transportation and capital costs, Sandwell (1977) reports an average variable cost of production in 1976 of $193 Canadian per ton for Ontario and Quebec producers and $184 Canadian for producers in the southern U.S. It should be noted that Sandwell indicates a very wide range of costs for Canadian producers; we shall argue below that many producers faced a significantly larger disadvantage than these averages suggest.

The data in Ontario (1981), which were compiled by the present authors, indicate that in 1980 the production of newsprint from existing facilities was considerably more costly in Ontario than it was in Quebec or in the southern U.S. In Ontario average variable production costs, including transportation costs, ranged between $299 and $352 Canadian per ton, whereas costs ranged between $275 and $326 in Quebec and between $261 and $307 in the southern U.S. The bulk of U.S. capacity would be toward the low end of the range, whereas much of the capacity in Ontario would be toward the high end of the range.[1]

The costs of kraft pulp production have traditionally been higher in Ontario than in the southern U.S. Table 3.2 presents summary data on the cost of producing bleached softwood dried kraft from new facilities in the three regions.

TABLE 3.1

Estimates of the cost of producing newsprint in greenfield facilities: $ Canadian per finished ton[a]

	Ontario	Quebec	Southern U.S.
1964 (Haviland, Takacsy, and Cape)		73	71
1965 (Daly)	78	78	71
1968 (Daly)	86	86	82
1980 (Ontario)	212–221	180–191	215–221

a U.S. production costs are expressed in Canadian dollars at the exchange rate prevailing in each period.

SOURCES: Haviland, Takacsy, and Cape (1968); Daly (1969); Ontario (1981).

TABLE 3.2

Estimates of the cost of producing kraft pulp in greenfield facilities: ($ Canadian per finished ton)

	Ontario	Quebec	Southern U.S.
1965[a]	104	–	89
1968[a]	118	–	107
1980[b]	282–317	265–310	234–63

a Daly (1969).

b Ontario (1981).

All estimates are given in Canadian dollars and exclude transporation costs and depreciation. It can be seen that the cost of production in Ontario was considerably higher than the cost in the southern U.S. It should be noted, however, that northern softwood bleached kraft pulp commands a price premium of $20–30 Canadian per ton over southern pulp.

Sandwell (1977) estimated that in 1976 the average cost per ton of producing pulp in existing facilities (again excluding depreciation and transportation costs) was $285 Canadian in Ontario, compared with an average of $184 Canadian in the southern U.S. The estimates derived by the present authors in Ontario (1981) show that in 1980 production costs per ton, excluding transportation costs, ranged between $303 and $369 in Ontario, $283 and $369 in Quebec, and $242 and $293 in the southern U.S. The majority of producers in Ontario faced costs in the range of $360–390 per ton *including* transporation costs. The comparable figures for Quebec and the southern U.S. south are $350–390 and $300–330, respectively.

The question immediately arises as to why the costs of newsprint and kraft pulp production were generally higher in Ontario than in Quebec and the southern U.S. Approximately 50 to 60 per cent of the cost of producing newsprint

and kraft pulp (excluding capital costs) is accounted for by wood and labour costs. An analysis of relative wood and labour costs in the three regions over the period 1960–80 provides a useful insight into the problems of the Ontario industry.

LABOUR COSTS

Table 3.3 presents data on wage rates in Ontario and the U.S. in both the pulp and paper sector and the manufacturing sector. (In Quebec, wage rates were marginally below rates in Ontario throughout the period in question.) To facilitate comparison, Canadian wage rates are shown in both U.S. and Canadian funds.

It should be noted that labour in the pulp and paper sector in both countries is very heavily unionized. This is true even in the southern U.S. We should have liked to obtain data specific to the southern U.S., but unfortunately industry-specific data was not available for that region for the entire period 1960–80. However, the available data does indicate that wage rates in pulp and paper in the U.S. as a whole differ only marginally from wage rates in pulp and paper in the southern U.S.

Table 3.3 shows that in both Ontario and the U.S. wage rates in the pulp and paper sector have typically been higher than average rates in the manufacturing sector in Ontario. The table also shows that in both Ontario and the U.S. wages in the pulp and paper sector have increased at a much faster rate than average wages in the manufacturing sector in Ontario.

We can conveniently delineate three distinct periods with respect to U.S. and Ontario wage rates in pulp and paper:

1. 1960–70: During this period the wage rate in the U.S. was higher than the rate in Ontario on both an exchange-adjusted and an unadjusted basis.

2. 1971–78: During this period both the exchange-rate-adjusted and the unadjusted wage rates in Ontario were higher than the U.S. wage rate. There were two reasons for this change. First, the wage rate in Canada increased dramatically—especially between 1971 and 1976. Second, there was a large increase in the value of the Canadian dollar *vis-à-vis* the U.S. dollar. In 1971, wage rates in Ontario were equal to 1.017 of the U.S. (exchange-adjusted) rate. By 1976, this ratio had risen to 1.266—an increase of 25 per cent. Thus per unit wage rates were 25 per cent higher in Canada than in the U.S. by the end of 1976.

3. 1979–82: the decline in the value of the Canadian dollar *vis-à-vis* the U.S. dollar that began in 1977 brought wage rates in Ontario (and Quebec) slightly below those in the southern U.S.

TABLE 3.3

Hourly earnings comparisons

	1	2	3	4	5	6
1960	$2.04	$2.43	1.030	$2.10	$1.88	.92
1961	2.12	2.51	.987	2.09	1.94	.91
1962	2.19	2.59	.936	2.05	1.99	.91
1963	2.24	2.67	.929	2.08	2.06	.92
1964	2.29	2.77	.927	2.12	2.13	.93
1965	2.36	2.88	.928	2.19	2.24	.95
1966	2.55	3.02	.928	2.37	2.37	.93
1967	2.71	3.16	.927	2.51	2.52	.93
1968	3.24	3.35	.928	3.00	2.71	.84
1969	3.51	3.58	.929	3.26	2.93	.84
1970	3.71	3.80	.958	3.55	3.18	.86
1971	4.16	4.05	.990	4.12	3.47	.83
1972	4.42	4.37	1.009	4.46	3.74	.85
1973	4.79	4.67	.999	4.79	4.06	.85
1974	5.51	5.29	1.022	5.63	4.53	.82
1975	6.10	5.55	.983	6.00	5.18	.85
1976	7.44	6.11	1.014	7.54	5.87	.79
1977	8.20	6.72	.940	7.71	6.47	.79
1978	8.71	7.44	.877	7.64	6.92	.79
1979	9.49	8.26	.854	8.10	7.48	.79
1980	10.22	9.14	.855	8.74	8.18	.80
1981	11.92	10.06	.834	9.94	9.12	.77
1982	12.85	10.90	.810	10.41	10.15	.79

COLUMNS:
1 Pulp and paper, Ontario, Canadian dollars.
2 Pulp and paper, U.S., U.S. dollars.
3 Exchange rate (Canadian dollars in U.S. dollars)
4 Pulp and paper, Ontario, in U.S. dollars
5 Manufacturing, Ontario
6 Column 5 divided by column 1
SOURCES: Statistics Canada; U.S. Bureau of Labor Statistics—Hours and Earnings; *Bank of Canada Review.*

A clear distinction must be drawn between wage rates as such and labour costs. Ontario (and Quebec) producers faced very considerably higher labour costs during the period 1960 to 1980 than did producers in the southern U.S. Not only was the cost of fringe benefits higher in Ontario than in the southern U.S. (Ontario 1981), but Ontario producers used significantly more labour per ton of output—especially in the production of newsprint—than did southern U.S. producers.

Until 1981, the bulk of Ontario newsprint capacity was in facilities installed before 1930; few machines were of post-1950 vintage. In contrast, the bulk of capacity in the southern U.S. was in machines of post-1966 vintage, and the oldest machine was of 1940 vintage.[2] Over the last thirty years dramatic increases in machine speed and machine trim (the width of the sheet of paper at the dry end of the paper machine) have greatly increased the feasible daily output from a single machine. Thus, given the much greater age of capacity in Ontario compared with capacity in the southern U.S., one would expect productivity to be much lower in the former than in the latter.

Table 3.4 presents summary data on newsprint capacity for 1979. These data indicate that the 'average' newsprint machine in the southern U.S. had approximately twice the daily ton capacity of the 'average' machine in Ontario.

Table 3.5 shows three alternative ways of producing 450 tons of newsprint per day and the required labour inputs per ton. The first two alternatives are representative of the situation in Ontario in 1979, and the third is representative of the southern U.S.

Data for 1979 given by the present authors in Ontario (1981) yield a labour cost per ton of output of $77 Canadian for an Ontario mill with the least dated equipment and $116 for a mill with the most dated equipment. By comparison, the range in the southern U.S. was $43 to $65 U.S.; most mills have a labour cost per ton of $50 to $60 U.S. Given the exchange range that prevailed through most of the 1970s, labour costs per ton of newsprint were between $25 and $60 Canadian higher in Ontario than in the southern U.S.

Ontario producers of bleached softwood kraft pulp also faced higher labour costs per ton of output than did producers in the southern U.S. However, the disadvantage was not as great as it was in the case of newsprint. For the bulk of Ontario capacity in 1979, the production labour requirement per ton of output ranged from 3 to 5 manhours, versus 2½ to 3½ manhours in the southern U.S. Given the exchange rate that prevailed in 1979, Ontario producers faced a higher labour cost per ton of output of $9 to $21.

WOOD COSTS

Although there are significant variations in the cost f.o.b. the mill of wood fibre across mills in a given region, wood costs also vary systematically across regions. Wood costs in Ontario have traditionally been considerably higher than costs in the southern U.S. south and somewhat higher than costs in other parts of eastern Canada.

We have been able to obtain a number of accurate 'spots' for the cost of roundwood, f.o.b. the mill. These are given in Table 3.6. It should be noted that

TABLE 3.4

Summary of newsprint machine characteristics

	Mean trim	Standard deviation	Mean speed	Standard deviation
Ontario	192″	62″	1,930 fpm	519
Southern U.S.	270″	46″	2,900 fpm	550

SOURCE: Ontario (1981).

TABLE 3.5

Alternate ways of producing 450 tons of newsprint

	Manhours per ton of output
3 machines — 160″ trim, 1,600 fpm	7½–8
2 machines — 235″ trim, 1,600 fpm	5½–6
1 machine — mid-1970s twin wire	2½–3½

SOURCES: Based on information in *Post's* (1980) and *Lockwood's* (various).

TABLE 3.6

Roundwood prices per cunit: [a] f.o.b. the mill

	Ontario	Southern U.S.
1972	$40 Canadian	$21.65 U.S.
1975	$63	$38.26
1979	$90–97	$58–66

a A cunit equals 100 cubic feet of wood

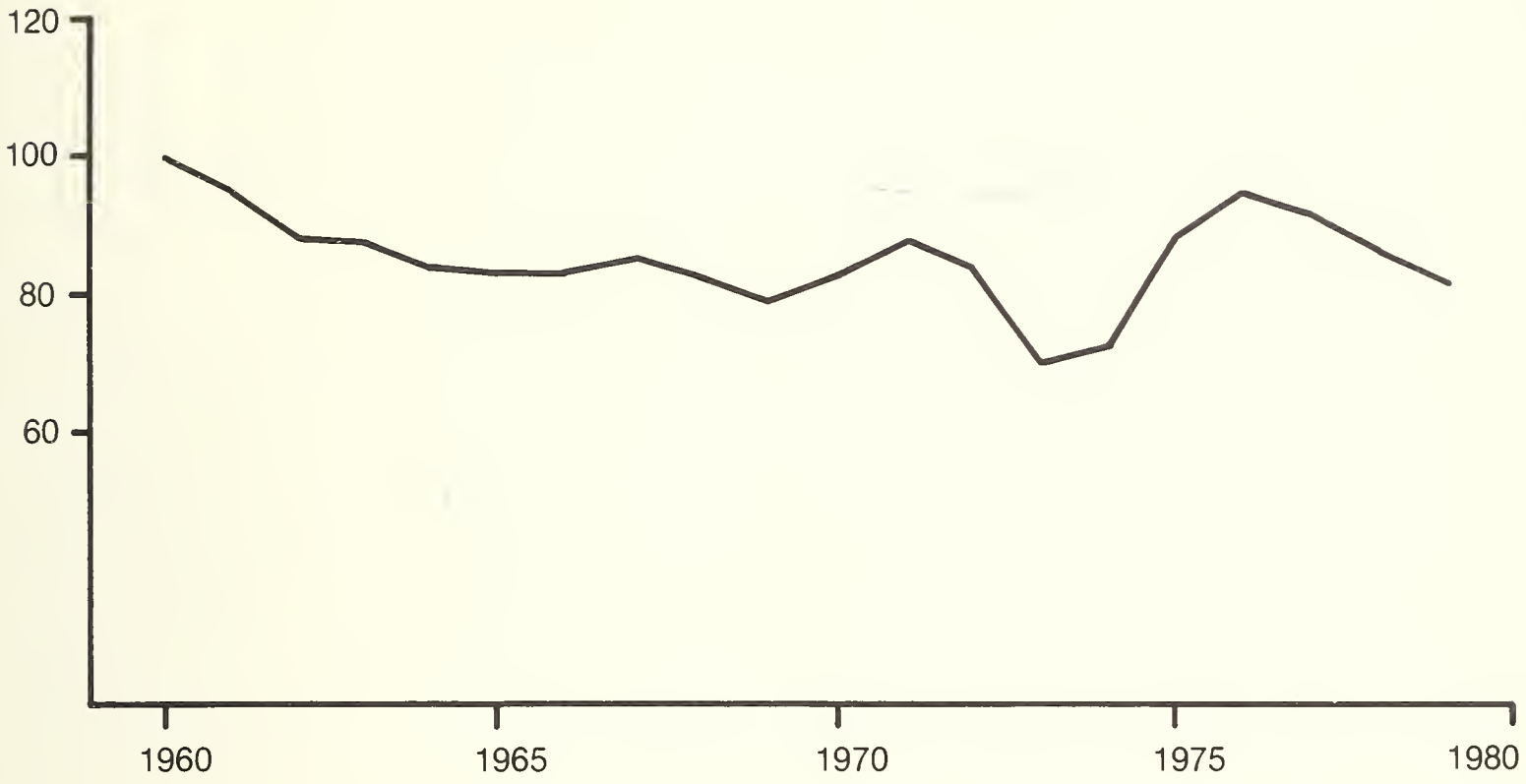
SOURCES: Statistics Canada 36-204 (various); Statistical Abstract of the United States (various); U.S. Forest Service, Southern Pine Pulpwood Prices (various).

southern pine — the predominant softwood species in the southern U.S. — contains more fibre per cubic foot than northern softwood species contain. Northern softwood has an average basic density of 24 bone-dry pounds of fibre per cubic foot, whereas the appropriate basic density of southern pine is 30 bone-dry pounds per cubic foot. Thus a cunit of southern pine will yield 25 per cent more fibre than will a cunit of Ontario or Quebec softwood.

Although the absolute cost difference between Ontario and the southern U.S. is very large, the relative disadvantage has not increased over the period 1960–80. Figure 3.1 gives the ratio of Ontario to southeastern U.S. wood costs (based on 1960 = 100) for the period 1960–79. Ontario's cost disadvantage fell through most of the 1960s and 1970s, but peaked during the years 1975–78 inclusive. This peak was largely the result of the relatively high value of the Canadian dollar *vis-à-vis*

FIGURE 3.1

Relative pulpwood price index (Ontario/southeastern U.S.) 1960 = 100



SOURCES: Ontario: Statistics Canada 36-204 (various). Value divided by volume of pulpwood used by pulp and paper companies. Converted to $U.S. at Bank of Canada average daily exchange rate. Southeastern U.S.: Statistical Abstract of the United States (various). U.S. Forest Service southern pine pulpwood prices in $U.S. per standard cord.

the U.S. dollar in those years and of high wage settlements in the Ontario woods industry.

Why are wood costs, f.o.b. the mill, higher in Ontario than they are in the southern U.S.? We can identify three main reasons. First, a very high proportion of the mill requirements of Ontario producers are cut by company-employed unionized work crews, whereas in the southern U.S. almost all cutting operations are handled by non-unionized workers. The labour cost per hour of cutting operations in the southeastern U.S. is only 55 to 65 per cent of the cost in Ontario. The cost in Ontario of woodcutting by non-unionized crews is 25 to 35 per cent below the cost of woodcutting by unionized company crews (see Peat, Marwick and Partners 1977). Second, the average yield of wood fibre per acre in northern Ontario is among the lowest in North America. The average yield in northern Ontario is 11 to 14 cunits per acre, while the yield is 14 to 17 cunits in Quebec and 10 to 25 cunits in the southeastern U.S. (ibid.). Third, the costs of moving wood from the roadside to the mill are considerably higher in northern Ontario than they are in the southeastern U.S., largely because producers in the southeastern

U.S. are generally located nearer to their wood sources than are producers in northern Ontario (see Ontario 1981).

PRODUCTION COSTS: 1982

The major aim of this section is to derive estimates for 1982 of the cost of producing newsprint and kraft pulp in the three regions from greenfield capacity.

Newsprint

In the past five years there has been a significant increase in newsprint capacity in both Canada and the United States. This increase has involved both the installation of new machines at existing facilities and the construction of greenfield facilities. Almost all investment in greenfield capacity has taken the form of the installation of a high-speed twin wire paper machine with an operating speed of between 3,750 and 4,000 fpm and the construction of a thermo-mechanical pulping process (TMP). In a 'pure' TMP process, the chemical and groundwood pulps are replaced with a TMP furnish. The TMP process has two significant advantages over the traditional chemical pulp/groundwood process. First, it eliminates the exceedingly heavy capital expenditures required to achieve acceptable emission standards for chemical pulping facilities. Second, the yield from wood fibre inputs in a TMP process is between 95 to 98 per cent, compared with a yield of only 60 to 70 per cent from a high-yield sulphite process. Moreover, a TMP process is economically viable at low levels of output, whereas chemical pulping involves very large economies of scale.

An analysis of recent greenfield newsprint construction indicates that a typical facility is designed to operate at a capacity of 192,500 tons per year, equal to 550 tons per day. Table 3.7 presents summary data on operating costs for such a facility in each of the three regions.[3] Costs are given in Canadian dollars for Ontario and Quebec and in U.S. dollars for the American south. To facilitate comparison, production costs in the southern U.S. are also shown in Canadian dollars, with the value of the Canadian dollar set at $.85 U.S.[4]

It can be seen from Table 3.7 that wood, labour, energy, and transportation costs account for almost 80 per cent of operating costs. A comparison of costs in the three regions shows that:

1. Wood costs in Ontario are considerably higher than wood costs in Quebec and the southern U.S. If no adjustment is made for exchange rates, U.S. producers enjoy an advantage over Ontario producers of $37 to $41 per ton of newsprint. Even when the value of the Canadian dollar is assumed to be $.85 U.S., Ontario producers are at a considerable disadvantage in respect of wood costs.

TABLE 3.7

Cost in 1982 of producing newsprint: greenfield capacity (per finished ton)

	Ontario $ Canadian	Quebec $ Canadian	Southern U.S. $ U.S.	Southern U.S. $ Canadian
Wood cost	82–92	70–79	45–51	53–60
Labour costs	52	52	39	46
Energy costs	60	35	80	94
Transportation costs	57	55	40	47
Maintenance and operating supplies	30	30	30	35
Other costs (including sales, Head office, property taxes, and insurance)	25	25	24	28
Total	$306–16	$267–76	$258–64	$303–10

SOURCES: Based on confidential data provided by a number of major producers and on information in trade journals.

2. Labour costs in Ontario and Quebec are similar, while on an exchange-unadjusted basis labour costs are 25 per cent lower in the southern U.S. than they are in Ontario and Quebec.

3. Energy costs are lowest in Quebec and highest in the southeastern U.S. It should be noted that the production of high-quality newsprint from a TMP furnish requires a very large input of electrical power.[5]

4. Ontario producers are at a considerable disadvantage relative to U.S. producers with respect to transportation costs. It is assumed that mills located in Ontario ship a large proportion of their total output to markets in the American midwest, whereas Quebec mills ship the majority of their output to the U.S. eastern seaboard. Mills in the southern U.S. ship most of their output to points within the south and points in the central and lower midwestern states. The higher transporation costs faced by Ontario and Quebec producers are attributable to two main factors. First, the average length of haul is less for southern producers than it is for Ontario and Quebec producers. Second, line haul rates per ton mile are lower for shipments originating in the southern U.S. than they are for shipments originating in Ontario or Quebec. The transportation costs given in Table 3.7 include an allowance for transhipment and warehousing costs.

In the absence of an exchange-rate adjustment, Ontario producers face a disadvantage in operating costs of approximately $50 per ton relative to producers in the southern U.S. and approximately $40 per ton relative to producers in

Quebec. The assumed exchange-rate adjustment essentially eradicates the disadvantage of Ontario producers relative to producers in the southern U.S.

Information given in trade journals and detailed data supplied by a number of major producers suggests that in 1982 the capital cost of constructing a 550 ton per day greenfield newsprint facility is approximately $190 million Canadian. This estimate includes the interest charges incurred during the construction period. For the southern U.S., the estimated capital cost in 1982 was $176 million U.S.

Kraft pulp

A number of greenfield pulp mills have been constructed in recent years; others are under construction. The minimum economic size for a bleached kraft pulp mill is approximately 350,000 tons per annum. Table 3.8 presents summary data on operating costs per ton of output for such a facility in each of the three regions. All costs are given in Canadian dollars for Ontario and Quebec and in U.S. dollars for the southern U.S. To facilitate comparison, U.S. costs are also shown in Canadian dollars, with the exchange rate set to $1 Canadian = $.85 U.S.

It can be seen from Table 3.8 that Ontario producers and (to a lesser extent) Quebec producers face considerably higher production costs than do producers in the southern U.S. The cost disadvantage is almost exclusively a result of the higher cost of wood fibre in the two provinces. The production of kraft softwood pulp is more wood intensive than the production of newsprint. In Quebec and Ontario, an air-dry ton of pulp requires an input of approximately 2.2 bone-dry tons of softwood, equal to 1.8 cunits of roundwood. For mills located in the southeastern U.S., the wood requirement is only 1.45 cunits, given the higher basic density of southern pine. The wood costs in Table 3.8 are based on the average roundwood/woodchip rates prevailing in each region.

The estimated capital cost of constructing a 1,000-ton-per-day kraft pulp mill in Ontario or Quebec would have been approximately $450 million Canadian in 1982; this figure includes the interest charges incurred during the construction period.[6] Landegger (1980) estimates that the more stringent U.S. pollution standards would have necessitated an additional expenditure for southern mills of $10 to $15 million in 1980 (given a Canadian dollar equal to $1 U.S.). However, this amount would have been more than offset by lower construction costs in the southern U.S. Our estimate of capital costs for a facility in the southern U.S. south are $435 million U.S.

CONCLUDING COMMENTS

It has been shown above that, prior to any adjustment for exchange rates, Ontario

TABLE 3.8

Cost in 1982 of producing kraft pulp: greenfield capacity (per air dried ton)

	Ontario $ Canadian	Quebec $ Canadian	Southern U.S. $ U.S.	Southern U.S. $ Canadian
Wood cost	170–98	152–94	87–107	102–26
Labour costs	50	50	37	44
Energy costs	17	20	23	27
Transportation costs	40–50	48–54	42–46	49–54
Chemical costs	49	43	40	47
Maintenance and operating supplies	25	25	25	29
Other costs	24	24	24	28
Total	$375–413	$362–410	$278–302	$327–55

SOURCES: Based on confidential data provided by a number of major producers and on information in trade journals.

producers face higher unit production costs for both newsprint and kraft pulp than do producers in the southern U.S. In addition, Ontario producers are at a cost disadvantage relative to Quebec producers. The position of Ontario producers relative to southern U.S. producers is sensitive to exchange rates. This issue will be examined in detail in Chapter 5.

While production costs, given exchange rates, capacity utilization, and market prices, determine the pre-tax profitability of investment in each of the three regions, investment decisions are based on anticipated after-tax profitability. Chapter 4 describes the corporate tax environment in each of the three regions.

NOTES

1 Prior to 1981, a high proportion of capacity in Ontario was in facilities installed before 1930. In the southern U.S., a high proportion of capacity was in machines installed after 1966.
2 Data on machine vintages are contained in *Post's* (1980) and *Lockwood's* (various).
3 A detailed discussion of the technical requirements is given by the present authors in Ontario (1981).
4 In the empirical analysis reported in Chapter 5, the value of the Canadian dollar is allowed to vary between $1 U.S. and $.80 U.S.
5 Hussan and Syrjanen (1980) provide a discussion of energy requirements for TMP production.
6 Based on information in trade journals and confidential data supplied by a number of producers.

4
The Corporate Tax Environment

INTRODUCTION

Over the past twenty years, the corporate tax environment for manufacturing industries in North America has been subject to a large number of changes. Apart from frequent changes in corporate tax rates, the most significant changes have been changes in the treatment of depreciation allowances and the introduction of investment incentives via investment tax credits (ITCs).

The imposition of a tax on corporate income will cause the effective after-tax internal rate of return (IROR) to diverge from the before-tax IROR. In the absence of inflation, the effective tax rate will equal the statutory tax rate if depreciation for tax purposes equals economic depreciation, where the latter is defined as the marginal change in the market value of the asset. In the presence of inflation, depreciation allowances must be indexed in order for the two rates to be equal. In general, the size of the wedge driven between pre- and post-tax rates of return depends on the rate at which income is taxed, the manner in which investment is depreciated for tax purposes, inflation, and the availability of investment tax credits.

In North America, the depreciation that firms may claim for tax purposes is normally restricted to the original or 'historic' cost of the investment. Annual depreciation allowances are not adjusted for inflation, and in consequence the real value of depreciation allowances is reduced by the presence of inflation. Real after-tax rates of return are affected by inflation in two important respects. First, since higher rates of inflation cause greater decreases in the real value of depreciation allowances than do lower rates of inflation, real after-tax IRORs progressively decrease as the rate of inflation increases. Second, since depreciation allowances are based on historic cost, inflation makes investment in capital assets that have a long life less profitable than investment in capital assets that have a short life. One

solution to these problems is to insulate the after-tax rate of return from inflation by fully indexing depreciation changes. It must be noted, however, that indexing capital consumption allowances is an inherently complex and difficult process. Although this method has been used in a number of countries, it has not been adopted in North America.

Recognition of the fact that the after-tax real rate of return is not simply a function of the rate at which corporate income is taxed has led to the introduction of a large number of changes in corporate tax systems designed to provide investment incentives by increasing the after-tax real rate of return. In general, one can identify two distinct classes of such incentives: those that affect after-tax IRORs by increasing the present value of depreciation allowances and those that affect after-tax IRORs by offering incentives over and above alterations to the depreciation stream.

The most frequently used method of increasing the present value of depreciation allowances is to permit depreciation to be taken at accelerated rates. Two widely used variants are the double-declining balance method and the sum-of-years-digits method. Table 4.1 presents an example of the way in which the timing of depreciation allowances is altered by the introduction of accelerated depreciation schemes. For ease of exposition, the example uses an asset with a ten-year life and historic cost of $1,000. The most rapid method of depreciation is to allow firms to treat capital costs as expenses. That is, the entire cost of acquiring an asset is set against income in the year of acquisition.

Investment incentives not related to the timing of depreciation allowances have been incorporated into tax systems in two main fashions: the investment allowance method and the tax credit method. The former method allows the firm to write off a designated portion of any capital asset immediately and then apply normal depreciation. The latter method allows the firm a tax credit equal to a designated proportion of the capital investment plus either normal depreciation on the entire investment or depreciation on the investment after the amount has been reduced by the value of the tax credit.

Corporate tax systems in the United States and Canada have incorporated investment incentives both by increasing the present value of depreciation allowances and by introducing investment tax credit allowances. In the United States, accelerated depreciation allowances were first introduced in 1954. In 1962, asset lives were shortened by between 30 to 40 per cent, and in 1971 the introduction of the asset depreciation range (ADR) further shortened permissible write-off periods. An investment tax credit was first enacted in the U.S. in 1962. This credit, like the 1962 revisions of depreciation policy, was aimed directly at increasing capital investment outlays and the national growth rate. Initially, The ITC was set at 7 per cent for equipment with a useful life of eight years or more. A lower credit was

TABLE 4.1

Accelerated depreciation allowances

Year	Straight Line[a]	Double-declining balance[b]	Sum-of-years-digits[c]
1	100	200	182
2	100	160	164
3	100	128	145
4	100	102	127
5	100	82	109
6	100	66	91
7–10	400	262	182

a $1,000 divided by the useful life.

b Compute yearly straight line depreciation against undepreciated balance and multiply by 2.

c Multiply $1,000 by the remaining years of useful life to the sum of the years of useful life. That is, year 1 = 10/55, year 2 = 9/55, etc.

allowed for assets with useful lives of four to eight years and no credit was allowed for assets with useful lives of less than four years. Credits of more than $25,000 could be used to reduce tax liability by no more than 25 per cent (increased to 50 per cent in 1967), but excess amounts could be carried forward for five years. Initially, the ITC served to reduce the depreciable base of the asset.[1] This provision was repealed in 1964. The ITC was suspended in October 1966, but a dramatic decline in the level of investment brought about its reintroduction five months later. The ITC was repealed in 1969 but reinstituted on equipment in 1970; it has since become a permanent part of the U.S. corporate tax system.

Greatly accelerated depreciation allowances were first introduced in Canada, in 1963. The 1963 provision allowed for a two-year straight-line write-off for machinery and equipment used in the manufacturing and processing sector; however, this write-off was restricted to firms with a certain proportion of Canadian ownership. The measure was intended to increase the rate of recovery from the 1961 recession and to increase incentives for Canadian ownership of manufacturing and processing facilities. The scheme was terminated in 1966. Harman and Johnson (1978) estimate that only 29.5 per cent of investment in machinery and equipment in manufacturing and processing during 1963–66 was eligible for the two-year write-off.

In 1966, the federal government, concerned this time with too fast a rate of growth, cut capital cost allowances on buildings and machinery and equipment purchased between 29 March 1966 and 1 October 1967 by 50 per cent (10 per cent for all other assets) for a three-year period. (Investments that were the subject of the 1963 accelerated provision were exempted from the deferral of capital cost recovery.)

In 1970, in response to a slowing down in the level of investment in manufacturing, the federal government increased the capital base for depreciation on a wide range of assets purchased between 2 December 1970 and 22 March 1972. As Harman and Johnson (1978) note, the restrictions on the availability of this incentive were relatively modest and in consequence it can be assumed that almost all machinery and equipment used in manufacturing and processing benefited from the additional allowance. In 1972, two-year straight-line depreciation of machinery and equipment used directly or indirectly in manufacturing and processing was introduced, a provision that remained in force until 1982.

An investment tax credit was introduced in 1975 and, with modifications, remains a feature of the Canadian corporate tax system today. The ITC was originally set at 5 per cent of the cost of buildings and machinery and equipment in a wide range of activities. The maximum credit was $15,000 plus one-half of the tax payable in excess of $15,000, with a carry-forward of five years for unused credits. Table 4.2 traces the development of the ITC over the period 1975–82.

Any changes in the ITC or in the manner in which firms are allowed to take depreciation for tax purposes will lead to changes in effective tax rates and after-tax IRORs. Because front-end tax breaks reduce the real cost of capital, one would expect net investment to be increased, at the margin, by the front-end tax abatements. A large number of econometric studies have attempted to quantify the effect of the ITC and accelerated depreciation allowances on corporate investment behaviour. Using a neo-classical model, Jorgensen (and others) found that both the ITC and the fast-write-off provisions led to a substantial increase in investment in the U.S. (see Jorgenson 1971; Hall and Jorgenson 1967). McFetridge and May (1976), applying the basic Jorgensen model to Canada, reported that the two-year straight-line accelerated depreciation provision introduced in 1972 caused net investment to rise by 3.55 per cent in 1973, 6.42 per cent in 1974, and 7.15 per cent in 1975. In general, the effect on net investment of the tax incentives had an initial lag of one year, with the modal impact occurring in the third year after the introduction of the incentive. Harman and Johnson (1978) report essentially similar results with respect to both magnitude and timing.

Since 1980, the corporate tax environments in both Canada and the United States have not only changed significantly but for the first time in over twenty years have moved in very different directions. In the United States, changes in the treatment of depreciation allowances and the ITC have led to large reductions in effective tax rates in manufacturing and processing, whereas in Canada the reverse has occurred. Chapter 5 demonstrates in detail how different tax treatments result in different effective tax rates and after-tax IRORs. The balance of this chapter briefly describes the salient features of the corporate tax systems in Canada and the U.S. as they relate to the pulp and paper sector for the period 1980–83.

TABLE 4.2

Investment tax credit rates: 1975–82

24 June 1975–31 March 1977	
Canada (all)	5%
1 April 1977–16 November 1978	
Atlantic Provinces & Gaspé	10%
Designated regions	7.5%
Other	5%
17 November 1978 and subsequently	
Atlantic Provinces & Gaspé	20%
Designated regions	10%
Other	7%
29 October 1980 and subsequently	
Special designated area	50%

CANADIAN FEDERAL TAX SYSTEM

Nominal tax rate

The nominal tax rate on corporate income in Canada is 46 per cent. However, an abatement of 10 percentage points to provide 'tax room' for the provinces and a 6-point allowance for manufacturing and processing reduce the nominal tax rate to 30 per cent. Since 1980 the federal government has imposed a 'temporary' surcharge of 5 per cent, raising the nominal federal tax rate on manufacturing and processing activities to 31.5 per cent.

Capital cost allowance

Before 1981, machinery and equipment (class 29 assets) carried a 50 per cent write-off in the year of acquisition, and the balance was eligible for deduction in any subsequent year. The two-year write-off on machinery and equipment clearly represented a significant front-end advantage to pulp and paper producers, given that the bulk of investments in machinery and equipment have a relatively long asset life. Structures were depreciated on a 5 per cent declining balance basis.

Investment tax credit

The value of the Canadian ITC depends upon the region in which investment takes place. For the 1980–82 tax years, the basic rate was 7 per cent; a 10 per cent rate prevailed in designated slow-growth areas, a 20 per cent rate in the Atlantic Provinces and the Gaspé region of Quebec, and a 50 per cent rate in 'special' designated areas. Special designated areas include approximately 5 per cent of the Canadian population. The designation is restricted to areas that have a high level

of unemployment and low income and excludes all large population centres. Unlike the American ITC, the Canadian ITC is applicable to structures as well as to machinery and equipment.

For federal-tax purposes, the ITC reduces the cost of property for the calculation of the depreciation base. The maximum tax credit is $15,000 plus half of the tax otherwise payable in excess of $15,000, with a carry-forward limited to five years.[2] In order to take advantage of the ITC, a firm must create a tax liability equal to twice the ITC itself. For the purposes of this paper, we have assumed a value of 10 per cent for the ITC, since pulp and paper investments will generally be located in regions subject to this level of the ITC.

The major change to the corporate tax system for the 1982 (and subsequent) tax years was the introduction of a half-year depreciation convention. For assets acquired after 12 November 1981, the first year's depreciation allowance is cut in half.[3] Thus the two-year straight-line write-off for machinery and equipment has effectively been nullified. The maximum allowable depreciation on machinery and equipment is as follows:

Year 1—25 per cent
Year 2—50 per cent
Year 3—25 per cent

Chapter 5 will show that the large decrease in the 'front-end' tax treatment of depreciation allowances consequent to the introduction of the half-year convention has led to a relatively large increase in effective tax rates.

U.S. FEDERAL TAX SYSTEM

Nominal tax rate

A nominal corporate tax rate of 46 per cent is in effect in the United States. State income taxes are deducted from income in arriving at the federal tax base.

Capital cost allowance

Before 1981, the Internal Revenue Service effectively mandated an average service life of twelve years for machinery and equipment used in the pulp and paper sector. Firms were allowed to elect the 'sum-of-years-digits' depreciation method and switch to straight-line depreciation when this produced a larger capital consumption allowance than the 'sum-of-years-digits' method. Structures carried a thirty-five-year life and were depreciable on a 150 per cent declining

balance basis; firms could switch to straight-line depreciation if they wished. All assets were deemed to be placed in service at the mid-point of the year, and in consequence allowable depreciation in the first year was reduced by half; this provision is still in force.

It is clear that before 1982 the Canadian federal tax treatment of depreciation allowances allowed a considerably faster write-off, and in consequence a larger 'up-front' tax advantage, then did its American counterpart.

Investment tax credit

Before 1981, the ITC in the U.S. was equal to 3 1/3 per cent on equipment with a three-to-five-year life, 6 2/3 per cent on equipment with a five-to-seven-year life, and 10 per cent on equipment with a life in excess of seven years. Unlike the Canadian ITC, the American ITC is not applicable to structures. Nor does the American ITC reduce the cost of property for the calculation of depreciation base, as does its Canadian counterpart.

The maximum tax credit is $25,000 plus half of the tax otherwise payable in excess of $25,000. Unclaimed credits can be carried forward five years.

1981 Economic Recovery Tax Act

The changes to the U.S. corporate tax system contained in the 1981 Economic Recovery Tax Act have greatly liberalized the treatment of depreciation and investment tax credits for federal tax purposes. The accelerated cost recovery system (ACRS) incorporated in the act greatly reduces asset life for tax purposes, thus permitting faster write-offs. Under the ACRS, machinery and equipment is assigned a five-year life. Firms calculate depreciation using a 150 per cent declining balance method, with the option of switching to straight-line depreciation. Structures are accorded an asset life of ten or fifteen years; for the shorter term depreciation is calculated on a 150 per cent declining balance basis and for the longer term it is calculated on a 175 per cent declining balance basis. It is permissible in both cases to switch to straight-line depreciation.

The 1981 legislation allows an investment tax credit of 6 per cent on machinery and equipment with an asset life of three to five years and a credit of 10 per cent on machinery and equipment with an asset life in excess of five years. The maximum carry-forward of unused credits has been increased from five to fifteen years.

The most interesting feature of the Economic Recovery Tax Act is the fact that it allows producers to market unusued tax credits. In Canada (and in the U.S. before 1981), the real value to a firm of investment incentives embedded in the tax system depends on the amount of pre-existing income flow that the firm can shelter from corporate taxes through the acquisition of new capital goods. An 'old' firm can be defined as one that has an income flow sufficient to enable it to

take immediate advantage of the available ITC and the 'front-end' tax abatement made possible by the accelerated depreciation provision. A 'new' firm, in contrast, is one that is unable to take immediate advantage of the 'front-end' tax abatement and the ITC because it has an insufficient pre-existing income flow. As will be shown in Chapter 5, an old firm will enjoy a lower effective tax rate than will a new firm, except where tax credits are marketable. Provided that there is a perfect market for credits, the 'safe harbour' leasing provisions of the 1981 Economic Recovery Tax Act eliminate the old firm/new firm distinction. These provisions allow an investing firm with insufficient pre-existing tax liability to take full advantage of front-end tax incentives by essentially leasing equipment from a firm that does have enough tax liability to take full advantage of the incentives. The benefits of the tax incentives are passed on to the investing firm in the form of lower lease payments. Galper and Toder (1983) provide an excellent discussion of safe-harbour leasing. The U.S. Department of Treasury (1982) reports on the basis of an analysis of 2,000 safe harbour lease transactions that investing firms received 84 per cent of the tax benefits from safe harbour leasing.

PROVINCIAL TAXES

In Canada, the federal and provincial corporate tax systems are relatively highly integrated. As we noted earlier, the federal government allows provinces 'tax room' equal to a 10-point abatement in the corporate tax rate. Provided that a province adopts the federal tax base, the federal government will act as a tax-collector for that province, in which case the provincial corporate tax rate can be viewed as a simple add-on to the federal rate.

Ontario

Ontario has not adopted the federal corporate tax base and therefore administers its own tax system. There are two major differences between the Ontario and the federal tax treatments.[4] First, Ontario does not follow the federal practice of reducing the capital consumption allowance by the amount of the ITC. Second, Ontario has not adopted the half-year depreciation convention. In consequence, the Ontario corporate tax system provides greater front-end tax abatement than does the federal system.

Ontario levies a nominal tax rate of 13 per cent on 'eligible Canadian profits' from manufacturing and processing and a rate of 14 per cent on non-eligible profits.[5] Basically, all net income from pulp and paper operations in Ontario is eligible for the lower rate. For corporation tax years ending after 10 May 1983, both rates will increase by 1 per cent.

Quebec

Although Quebec administers its own corporate tax system, the tax base for manufacturing and processing is identical to the federal tax base. 'Eligible' business income, which encompasses income from virtually any manufacturing, processing, mining, agricultural, or trading operation, has, in recent years, been taxed at a much lower rate than 'non-qualifying' income.[6] Quebec levied a rate of 13 per cent on eligible income in 1980 and 1981, reducing this to 8 per cent for 1982 and 5.5 per cent for 1983.

STATE TAXES

The federal and state tax systems in the United States are much less integrated than the federal and provincial systems in Canada. The major difference between the U.S. and the Canadian tax systems in terms of the federal/sub-federal corporate tax environment lies in the effect of taxes levied by one level of government on the tax base for the other level of government. Because of the integrated nature of the Canadian system, taxes levied by one level of government are not deductable from income in arriving at the tax base for the other level. In the United States, firms deduct federal income taxes from income to arrive at the base for state taxation and deduct state taxes from income to arrive at the base for federal taxation.[7]

State taxation of corporate income is a less significant factor in determining the corporate tax environment than is provincial taxation. In most cases, and especially in the southern U.S., state corporate tax rates are relatively low and, given the deductability feature described above, the nominal tax rate is quite small. For example, given the nominal federal tax rate of 46 per cent and a state corporate tax rate of 6 per cent, the integrated nominal tax rate would be 47.74 per cent, to which the state system would contribute only 3.24 per cent.

For the purposes of this study, the Alabama corporate tax system has been chosen for modelling for the following reasons. First, the Alabama system is reasonably representative of state taxation of corporate income in the southern U.S. Second, there has been a very large increase in pulp and paper capacity in the state in recent years. Given the relatively low state corporate tax rates, the results reported in Chapter 5 would not be altered significantly if other southern U.S. state tax systems were substituted for the Alabama system.

Table 4.3 presents a summary of the major features of the Canadian and the American corporate tax systems.

TABLE 4.3

Major features of the corporate tax systems for pulp and paper

Federal tax	*Canada pre-1982*	*Canada 1982*	*U.S. pre-1981*	*U.S. ACRS*
1. Nominal rate	31.5%	31.5%	46%	46%
2. Capital cost allowance			Half-year convention	Half-year convention
a) Machinery and equipment	50%	Yr. 1: 25% Yr. 2: 50% Yr. 3: 25%	12-year life, sum-of-years-digits, switching to straight-line	5-year life, 150% declining balance, switching to straight-line
b) Structures	5% declining balance	5% declining balance	35-year life, 150% declining balance, switching to straight-line	10-year life (150%) and 15-year life (175%) declining balances, switching to straight-line
3. Investment tax credit				
a) Machinery and equipment	10%	10%	3⅓% on 3–5 yr. equipment 6⅔% on 5–7 yr. equipment 10% on 7 year + equipment	6% on 3– yr. equipment 10% on 5 year + equipment
b) Structures	10%	10%	0%	0%
c) Limitations:	(1) reduces cost of property for CCA (2) credit limit to $15,000 plus ½ of the tax otherwise payable in excess of $15,000 (3) 5-year carry forward	(1) reduces cost of property for CCA (2) credit limit to $15,000 plus ½ of the tax otherwise payable in excess of $15,000 (3) 5-year carry forward	(1) no reduction for CCA (2) credit limited to $25,000 plus ½ of the tax otherwise payable in excess of $25,000 (3) 5-yr. carry forward	(1) no reduction for CCA (2) credit limited to $25,000 plus ½ of the tax otherwise payable in excess of $25,000 (3) 15-year carry forward

TABLE 4.3 (Continued)

Provincial and state tax	*Ontario*	*Quebec*	*Alabama*
1. Nominal rate:	1980–82: 13% 1983: 14%	1980–81: 13% 1982: 8% 1983: 5.5%	5%
2. Base:	(1) ITC does not reduce cost of property for CCA. (2) No half-year convention.	Same as federal	Federal Base before net operating losses and special deductions. Federal taxes are deducted from income, and any state income taxes deducted in arriving at federal taxable income are added back in. Franchise tax of $3,000 per million of capital stock.

NOTES

1 The so-called Long Amendment.
2 The federal budget of April 1983 contained a number of significant changes in the ITC provisions. For investments made after 19 April 1983, the ITC may be used to reduce federal tax payable *without limit*. The budget also proposed a three-year carry-back (to be phased in over a two-year period) and an extension of the five-year carry-forward to seven years.
3 Companies that entered into binding agreements prior to 13 November 1981 to acquire property were to be allowed the full-year write-off, provided the assets were acquired before 1 January 1983.
4 There are, of course, many differences between the Ontario and Federal corporate tax systems. We are concerned here with only the tax treatment of large manufacturing and processing corporations.
5 Differential rates were introduced in April 1979.
6 A 'non-qualifying' business includes a professional practice, management service corporation, and a 'personal service' business. The definition for Quebec tax purposes is essentially identical to that adopted by the federal tax system.
7 However, not all states adopt the federal tax base. The introduction of the ACRS system has led a large number of states to 'uncouple' their tax bases from the federal base.

5
Profits, Taxes, and Inflation: Empirical Results

This chapter pulls together the cost information from Chapter 3 and the tax systems described in Chapter 4 into an analysis of expected before- and after-tax rates of return (IRORs) on greenfield projects located in Ontario, Quebec, and the southern United States. The first section develops the theoretical framework used in the computer calculations of the rates of return and reports the main results. The second section examines the empirical results from the standpoint of interregional profitability comparisons by breaking down interregional differences in after-tax IRORs into the differences attributable to factor price and productivity differentials and the differences attributable to interregional variations in tax treatment. Tax effects are separated from the other effects on profitability by applying the tax system of one region to the cost structures of other regions. The third section examines the sensitivity of after-tax IRORs in eastern Canada to the assumed range of exchange rates employed in the profitability simulations. The fourth section looks at the effects of tax sheltering and variations in the assumed rate of nominal price inflation on the profitability of new projects. The final section deals with the modernization incentives issue raised in Chapter 2. The section compares the after-tax IRORs on pulp and paper projects in Ontario with threshold rates of return required to attract capital into the industry and discusses the effects of modernization grants on IRORs.

THEORETICAL FRAMEWORK AND MAIN RESULTS

Our calculation of the internal rates of return on new projects, as defined by the capital cost figures in Chapter 3, proceeds in two steps. First, we calculate the before-tax IRORs for the three North American regions, using 1982 operating costs and revenues. Second, we calculate the after-tax IRORs, using the corporate tax systems applicable to each of the regions. We also cross-match the tax systems

to the different regions: this allows us to examine the separate impacts of tax treatments and (pre-tax) cost structures on the empirical profitability (IROR) results. Both steps include a variety of fully anticipated rates of inflation and Canadian-U.S. dollar exchange rates.

Equation 1, reported in the introductory chapter, calculates the pre-tax IROR for stable prices and is repeated here:

$$K_0 = \sum_{t=0}^{40} \frac{[S_t - C_0(1+\delta)^t]}{(1+r)^t}, \qquad (1)$$

where K_0 is the initial capital expenditure on the greenfield newsprint mill or kraft pulpmill, S_t is annual operating revenue in year t, C_0 is initial operating cost, δ is the assumed rate of increase of operating cost annually, and r is the (real) pre-tax IROR. The trend factor for operating cost takes into account the likelihood that rising real wages will increase costs over the project's lifetime. Rising real wood costs would do the same, but current evidence does not indicate the presence of such a trend. Consequently, the results we report here assume constant real costs for wood. Operating cost (C_0) includes scheduled maintenance of the facilities involved in the initial investment so that the productivity of capital remains constant over the project's time horizon.[1] We selected a long time horizon (forty years) to ensure that the present value of any subsequent project returns are negligible.

An example of the way in which equation 1 works is as follows. The product prices used for the IROR calculations are $450 U.S. per short ton for newsprint in 1982 dollars, $522 U.S. per short ton for bleached kraft pulp for Ontario and Quebec producers and $500 U.S. for pulp for American producers. These prices are somewhat higher than observed prices for 1982 because we have attempted to remove the transitory impact of the recession. U.S. pulp prices are oridinarily lower than Canadian (northern) pulp prices by $20 to $30 per ton, owing to quality differentials.[2] The new newsprint mill is designed to operate at 192,500 short tons per year (see Chapter 3). The historical average operating rate is 90 per cent of design capacity; consequently the newsprint mill is assumed to produce 173,250 short tons per year. We use the same operating rate for the pulpmill, which is assumed to produce 315,000 short tons per year. Multiplying annual production by the assumed product prices generates (constant) S_t in equation 1 for U.S. locations. For Canadian locations, the U.S. values for S_t are divided by the assumed price of the Canadian dollar. We use four exchange rates in the analysis, ranging from $1 Canadian = $.80 U.S. to $1 Canadian = $.86 U.S. The initial operating cost term (C_1) for 1982 is expressed in units of the region's own

currency. Costs were reported in Chapter 3—$311 Canadian per short ton for new newsprint mills in Ontario, for example. (To allow for a gestation lag, C_0 and S_0 are set equal to zero.) The operating cost trend (δ) is set at .006 (.6 per cent per annum) for newsprint and at .005 for pulp. These trends reflect assumed increases in real wages of about 3.5 per cent per year applied to the fraction of operating costs accounted for by labour in the new newsprint mill (17 per cent) and the new pulpmill (14 per cent). The capital expenditure items that enter K_0 in equation 1 are machinery and equipment, buildings, and land. For example, the capital cost for the greenfield newsprint mill in Canada (Quebec or Ontario) is $190 million Canadian, consisting of $146 million for machinery and equipment, $39 million for buildings, and $5 million for land. With all of the assumed revenue and cost information in place, the computer program calculates r in equation 1.[3]

The introduction of one or another of the corporate tax systems described in Chapter 4 modifies equation 1. Calculation of the after-tax IROR takes into account the nominal corporation tax rate and the capital consumption allowances and investment tax credits. There is no allowance for interest expenses—this is an all-equity project. The (real) after-tax IROR (r^*) is calculated as follows:

$$K_0 = \sum_{t=0}^{40} \frac{(1-T)\,[S_t - C_0(1+\delta)^t] + T \cdot D_t + Z_t}{(1+r^*)^t}, \qquad (2)$$

where, in addition to the symbols defined in equation 1 and discussed above, T is the nominal corporate tax rate, D_t is the capital consumption allowance claimed at time t, Z_t is the investment tax credit claimed at time t, and the other symbols are as we defined them earlier. Nominal taxes reduce the after-tax net revenue stream as indicated. Since capital consumption allowances are deducted in the calculation of before-tax profits; the term $T \cdot D_t$ indicates the increase in after-tax net revenue that results from the deduction. The investment tax credit claimed at time t also generates a (dollar-for-dollar) rise in after-tax net revenue.

Each of the corporate tax systems embodies a different set of nominal tax rates, a different method of calculating capital consumption allowances, and a different range of stipulations on investment tax credits. Further, except under the accelerated cost recovery system (ACRS) in the United States, before-tax net revenue streams and tax liabilities may constrain the rate at which capital consumption allowances and investment tax credits can be claimed. We have distinguished the cases of two types of firm. An 'old' firm's cash flows and tax liabilities from existing operations permit it to take immediate advantage of the capital consumption allowances (D) and tax credits (Z) associated with building a new newsprint mill or pulp mill. A 'new' firm has no cash flows or tax liabilities other than those that emerge from the new project itself; the project stands on its own. For such a

firm, corporate taxation is on a 'project basis': the rate at which the firm can claim capital consumption allowances (D) and tax credits (Z) is constrained by the net revenues and tax liabilities that the new mill generates. The differences between the tax systems examined and the new firm/old firm distinction mean that the calculations of after-tax IRORs using equation 2 are relatively complex and require a slightly different computer program for each situation.

Given a stable price environment, equations 1 and 2 provide a sufficient basis for examining before-tax and after-tax project profitability in the three North American regions involved in the study, for examining the effect of assumed changes in the Canadian dollar exchange rate on profitability in the Canadian locations, and for assessing the effect of modernization grants. Over the past decade, however, the price environment in North America has been far from stable. Rates of inflation have generally been above 5 per cent per annum and have occasionally moved into the double-digit range. In order to accommodate anticipated inflation in our project evaluations, we have incorporated a range of uniform expected inflation rates into the real IROR calculations. Three inflation rates—0 per cent, 5 per cent, and 10 per cent—have been selected. If the expected percentage inflation rate is given as $(1+p)$, the before-tax IROR calculation in equation 1 becomes

$$K_0 = \sum_{t=0}^{40} \frac{[S_t - C_0(1+\delta)^t](1+p)^t}{(1+r')^t}, \tag{3}$$

where r' is now the *nominal* pre-tax IROR and the other symbols are as previously defined. A juxtaposition of equations 1 and 3 makes it clear that the real pre-tax IROR is invariant to the anticipated rate of inflation such that $r = [(1+r')/(1+p)] - 1$.

Equation 3 is of minor interest in its own right. The real significance of introducing anticipated inflation rates into the analysis emerges in the calculation of after-tax IRORs. This calculation requires that equation 2 be modified as follows:

$$K_0 = \sum_{t=0}^{40} \frac{(1-T)[S_t - C_0(1+\delta)^t](1+p)^t + T \cdot D_t + Z_t}{(1+r_p)^t}, \tag{4}$$

where r_p is the *nominal* after-tax IROR in the presence of the fully anticipated inflation rate p. The capital consumption allowance stream (D_t) and the investment tax credits (Z_t) are *not* indexed to the rate of inflation but are based on initial (historical) capital costs entering K_0. If, in equation 4, D_t *and* Z_t *were* to be indexed to inflation, then $T \cdot D_t (1+p)_t$ would replace $T \cdot D_t$ and $Z_t (1+p)_t$ would

replace Z_t. In this (hypothetical) indexing case, after-tax real IRORs would be invariant to expected inflation such that $r^*=(1+r_p)/(1+p)]-1$, just as in the pre-tax equations. Since capital consumption allowances and investment tax credits are not indexed, the inclusion of expected inflation rates in the project evaluation leads to a fall in the after-tax IROR relative to the IROR in a stable price environment. Thus, $[(1+r_p)/(1+p)]-1<r^*$.

The inverse relationship between expected inflation rates and the real after-tax IROR on new projects arises from the circumstance that firms must apply capital consumption allowances to historical cost. This situation has sparked proposals for 'inflation-proof accounting', either through indexing or through further acceleration of capital cost allowances to permit immediate write-off of capital costs (e.g., Auerbach and Jorgensen 1980; Feldstein 1981 and 1983; Hulten and Wykoff 1981). For new firms, as defined above, investment tax credits may be postponed by an insufficiency of immediate tax liability; this postponement further reduces after-tax IRORs in an inflationary environment relative to after-tax IRORs under stable prices. A more detailed discussion of the interactions between real after-tax IRORs and the expected rate of inflation occurs later in this chapter, in the context of our empirical results for new firms and old firms. These results apply to 1982 cost and revenue information and tax systems and update some of the conclusions reached in Anderson, Beaudreau, and Bonsor (1983).

An important measure of the wedge that corporate taxation drives between before-tax investment profitability and after-tax profitability is the *effective tax* rate, a measure used frequently in subsequent sections. Given that we are concerned with deriving the after-tax IROR for new (marginal) investments, the appropriate effective tax rate to calculate here is the marginal effective corporate tax rate. As Fullerton (1984) argues, this measure is designed to capture the incentives to use new capital. The effective tax rate is defined as the before-tax IROR minus the after-tax IROR, all divided by the before-tax IROR. Under stable prices, for example, the effective tax rate that emerges from equations 1 and 2 is $(r-r^*)/r$. When expected inflation rates are incorporated into the project evaluation, the (real) effective tax rate is calculated analogously.[4]

The presence of accelerated capital cost depreciation and investment tax credits cause effective tax rates to fall below the nominal tax rates (T) for all of the tax systems described in the previous chapter. For our new pulp and paper projects, we have assumed that the average productivity of capital can be maintained over a forty-year time horizon with appropriate maintenance and repair expenditures built into annual operating costs (C_t). The decline in the net revenue stream over time is therefore the result of rising real labour costs, modelled through the δ term in the equations. Ultimately, replacement investments are required, not because existing facilities have worn out (though of course they may be allowed to wear out after some point in time, either by design or through

neglect) but because modern facilities promise higher labour productivity, offsetting increased real wages. In this context, then, *economic depreciation* (as opposed to statutory capital consumption allowances) is primarily an allowance for obsolescence. If such an allowance (in addition to maintenance and repair costs) were actually deducted in arriving at (pre-tax) net revenue and the resulting net revenue stream were converted to an equivalent level net revenue stream R, then K_0 would equal R/r.[5] If nominal corporate taxes on the equivalent net revenue stream were now introduced at rate T, the after-tax rate of return r^* would emerge from $K_0=(1-T)\ R/r^*$, where the nominal and effective tax rates are equal ($T=(r-r^*)/r$).

If capital consumption allowances are set more generously than economic depreciation and if investment tax credits are added as a further investment incentive, all of our effective tax rates fall below nominal tax rates. Accelerated depreciation of historical capital cost can by itself reduce the effective tax rate to zero, if it is taken to the extreme of allowing the immediate write-off of capital cost against income (Brown 1948). Under this arrangement (which holds for many capital cost categories in the United Kingdom, for example), an old firm recovers $T \cdot K_0$ at once. If profit is subject to the same nominal tax rate, the arrangement is essentially *participatory*—that is, the private investor bears a fraction equal to $1-T$ of all costs (including capital costs) and receives a fraction equal to $1-T$ of all project revenues. The effective tax rate is zero. Of the tax systems examined here, only the pre-1982 Canadian tax systems come close to this extreme, owing to the combined effect of the federal system's two-year provision for capital consumption allowances on machinery and equipment and an investment tax credit at the provincial level.[6]

It should be noted that all of the IRORs calculated here are on an all-equity basis. Had bond financing been included in the project assumptions, the before-tax results would have been affected by the rate of interest and amortization assumptions applied to bond finance. In addition, the after-tax IRORs would have been influenced by the deductibility of interest payments in corporation tax calculations.

Tables 5.1 through 5.6 enumerate the main computational results derived from equations 1 through 4. All of the tables show results for the three different fully anticipated inflation rates employed. Tables 5.1, 5.2, 5.4, and 5.5 also portray the IROR results for the four different exchange rates used to derive Canadian project revenues. The column labelled 0 in the tables shows the before-tax IRORs. Each column refers to a corresponding tax system:

1. Pre-1982 Canada–Ontario corporate tax system applied to new firms, as defined above.
2. Pre-1982 Canada–Quebec corporate tax system applied to new firms.

3. Pre-1981 United States – Alabama corporate tax system applied to new firms.
4. Pre-1982 Canada – Ontario corporate tax system applied to old firms, as defined above.
5. Pre-1982 Canada – Quebec corporate tax system applied to old firms.
6. Pre-1981 United States – Alabama corporate tax system applied to old firms.
7. 1981 United States – Alabama Accelerated Cost Recovery System (ACRS).
8. 1982 Canada – Ontario corporate tax system applied to old firms (half-year convention).
9. 1982 Canada – Quebec corporate tax system applied to old firms (half-year convention).
10. 1982 Canada – Quebec corporate tax system applied to old firms (half-year convention, reduced provincial tax rate).

The effective tax rate applicable to each of the tax systems is shown in brackets under the after-tax IROR. For example, in Table 5.1, with a zero inflation rate and a value of $.82 U.S. for the Canadian dollar, the before-tax IROR is 20.65. With the 1982 Canada – Ontario tax system in effect (column 8), the after-tax IROR is 18.30, for an effective tax rate of .11 (that is, [20.65 – 18.30]/20.65).

The following section uses the results of Tables 5.1 through 5.6 to explain the causes of interregional differences in project profitability in terms of pre-tax interregional revenue–cost differentials and tax system differences.

INTERREGIONAL PROFITABILITY COMPARISONS

The analysis in this section is primarily directed at determining the effect that location has on the profitability of investments in newsprint and market pulp capacity relative to the effect that the corporate tax environment has on the profitability of such investments. The analysis takes into account the numerous changes that have occurred in the tax treatment of corporate income in Ontario, Quebec, and the southern U.S. over the period 1980 to 1983.

Empirically, we are able to draw a clear distinction between the effects on profitability of location and tax environments. Before-tax IRORs (column 0 in Tables 5.1–5.6) are determined, given exchange rates, by relative factor costs and are completely free of tax-induced effects. The before-tax IRORs thus serve as an index of the effect of location (relative production costs) on project profitability. For example, a comparison of column 0 in Table 5.1 and column 0 in Table 5.3 indicates that at an assumed exchange rate of $1 Canadian = $.82 U.S. an Ontario location has a distinct pre-tax advantage in the production of newsprint over a location in the southern U.S. The absolute pre-tax cost effect is equal to the Ontario pre-tax IROR (20.65) minus the IROR for the southern U.S. (17.52) and is

TABLE 5.1

Newsprint IRORs and effective tax rates: Ontario cost structure

	Tax System	0	1	2	3	4	5	6	7	8	9	10
0% Inflation $1 Can. =	$.86 US	18.20	13.81	13.71	12.09	17.15	16.84	13.18	15.72	16.23	15.68	16.40
			(.24)	(.25)	(.34)	(.06)	(.07)	(.28)	(.14)	(.11)	(.14)	(.10)
	.84	19.40	14.79	14.69	12.83	18.23	17.90	13.97	16.63	17.24	16.67	17.43
			(.24)	(.24)	(.34)	(.06)	(.08)	(.28)	(.14)	(.11)	(.14)	(.10)
	.82	20.65	15.82	15.73	13.60	19.35	19.01	14.78	17.58	18.30	17.70	18.51
			(.23)	(.24)	(.34)	(.06)	(.08)	(.28)	(.15)	(.11)	(.14)	(.10)
	.80	21.96	16.91	16.81	14.37	20.52	20.16	15.62	18.56	19.39	18.76	19.62
			(.23)	(.23)	(.35)	(.06)	(.08)	(.29)	(.15)	(.12)	(.15)	(.11)
5% Inflation $1 Can. =	$.86 US	18.20	13.49	13.41	11.40	16.87	16.58	12.51	15.04	15.89	15.35	16.11
			(.26)	(.26)	(.37)	(.07)	(.09)	(.31)	(.17)	(.13)	(.16)	(.11)
	.84	19.40	14.45	14.35	12.14	17.95	17.64	13.31	15.95	16.90	16.33	17.13
			(.26)	(.26)	(.37)	(.07)	(.09)	(.31)	(.18)	(.13)	(.16)	(.12)
	.82	20.65	15.42	15.32	12.91	19.06	18.74	14.13	16.88	17.94	17.35	18.20
			(.25)	(.26)	(.37)	(.08)	(.09)	(.31)	(.18)	(.13)	(.16)	(.12)
	.80	21.96	16.43	16.31	13.69	20.22	19.88	14.97	17.84	19.03	18.40	19.31
			(.25)	(.26)	(.38)	(.08)	(.09)	(.32)	(.19)	(.13)	(.16)	(.12)
10% Inflation $1 Can. =	$.86 US	18.20	13.12	13.04	10.92	16.64	16.36	12.05	14.50	15.61	15.08	15.86
			(.28)	(.28)	(.40)	(.09)	(.10)	(.34)	(.20)	(.14)	(.17)	(.13)
	.84	19.40	14.06	13.97	11.67	17.71	17.41	12.85	15.39	16.61	16.05	16.88
			(.28)	(.28)	(.40)	(.09)	(.10)	(.34)	(.21)	(.14)	(.17)	(.13)
	.82	20.65	15.00	14.90	12.43	18.81	18.50	13.66	16.31	17.65	17.06	17.94
			(.27)	(.28)	(.40)	(.09)	(.10)	(.34)	(.21)	(.14)	(.17)	(.13)
	.80	21.96	15.99	15.88	13.23	19.96	19.64	14.51	17.27	18.72	18.11	19.04
			(.27)	(.28)	(.40)	(.09)	(.10)	(.34)	(.21)	(.15)	(.17)	(.13)

TABLE 5.2

Newsprint IRORs and effective tax rates: Quebec cost structure

	Tax System	0	1	2	3	4	5	6	7	8	9	10
0% Inflation $1 Can. =	$.86 US	22.06	17.00	16.91	14.46	20.62	20.26	15.72	18.65	19.49	18.86	19.72
			(.23)	(.23)	(.34)	(.07)	(.08)	(.29)	(.15)	(.12)	(.15)	(.11)
	.84	23.23	17.97	17.82	15.16	21.65	21.28	16.46	19.52	20.46	19.81	20.72
			(.23)	(.23)	(.35)	(.07)	(.08)	(.29)	(.16)	(.12)	(.15)	(.11)
	.82	24.44	18.89	18.74	15.88	22.74	22.36	17.24	20.42	21.48	20.79	21.75
			(.23)	(.23)	(.35)	(.07)	(.09)	(.30)	(.16)	(.12)	(.15)	(.11)
	.80	25.74	19.86	19.70	16.63	23.87	23.47	18.05	21.35	22.54	21.82	22.83
			(.23)	(.23)	(.35)	(.07)	(.09)	(.30)	(.17)	(.12)	(.15)	(.11)
5% Inflation $1 Can. =	$.86 US	22.06	16.52	16.40	13.80	20.31	19.97	15.06	17.94	19.13	18.50	19.41
			(.25)	(.26)	(.37)	(.08)	(.09)	(.32)	(.19)	(.13)	(.16)	(.12)
	.84	23.23	17.41	17.28	14.49	21.35	21.00	15.82	18.80	20.09	19.44	20.39
			(.25)	(.26)	(.38)	(.08)	(.10)	(.32)	(.19)	(.14)	(.16)	(.12)
	.82	24.44	18.32	18.19	15.22	22.42	22.06	16.60	19.69	21.10	20.42	21.42
			(.25)	(.26)	(.38)	(.08)	(.10)	(.32)	(.19)	(.14)	(.16)	(.12)
	.80	25.74	19.28	19.15	15.98	23.55	23.17	17.41	20.61	22.15	21.44	22.50
			(.25)	(.26)	(.38)	(.09)	(.10)	(.32)	(.20)	(.14)	(.17)	(.13)
10% Inflation $1 Can. =	$.86 US	22.06	16.08	15.97	13.32	20.06	19.74	14.61	17.36	18.82	18.21	19.14
			(.27)	(.28)	(.40)	(.09)	(.11)	(.34)	(.21)	(.15)	(.17)	(.13)
	.84	23.23	16.96	16.85	14.03	21.09	20.75	15.36	18.21	19.78	19.14	20.12
			(.27)	(.27)	(.40)	(.09)	(.11)	(.34)	(.22)	(.15)	(.18)	(.13)
	.82	24.44	17.88	17.77	14.76	22.16	21.81	16.25	19.10	20.78	20.11	21.14
			(.27)	(.27)	(.40)	(.09)	(.11)	(.34)	(.22)	(.15)	(.18)	(.14)
	.80	25.74	18.85	18.74	15.52	23.28	22.92	16.96	20.01	21.83	21.12	22.21
			(.27)	(.27)	(.40)	(.10)	(.11)	(.34)	(.22)	(.15)	(.18)	(.14)

TABLE 5.3

Newsprint IRORs and effective tax rates: U.S. cost structure

Tax System	0	1	2	3	4	5	6	7	8	9	10
0% Inflation	17.52	13.27	13.18	11.70	16.60	16.27	12.78	15.22	15.69	15.16	15.84
		(.24)	(.25)	(.33)	(.05)	(.07)	(.27)	(.13)	(.10)	(.13)	(.10)
5% Inflation	17.52	12.94	12.87	11.01	16.33	16.03	12.11	14.55	15.36	14.84	15.56
		(.26)	(.26)	(.37)	(.07)	(.08)	(.31)	(.17)	(.12)	(.15)	(.11)
10% Inflation	17.52	12.62	12.54	10.54	16.11	15.81	11.64	14.01	15.09	14.57	15.22
		(.28)	(.28)	(.40)	(.08)	(.10)	(.34)	(.20)	(.14)	(.17)	(.13)

TABLE 5.4

Pulp IRORs and effective tax rates: Ontario cost structure

	Tax System	0	1	2	3	4	5	6	7	8	9	10
0% Inflation $1 Can. =	$.86 US	13.59	9.92	9.85	9.03	12.35	12.16	9.81	11.38	11.77	11.40	11.99
			(.27)	(.27)	(.34)	(.09)	(.10)	(.28)	(.16)	(.14)	(.16)	(.12)
	.84	14.69	10.81	10.73	9.73	13.32	13.13	10.54	12.22	12.71	12.31	12.94
			(.26)	(.27)	(.34)	(.09)	(.11)	(.28)	(.17)	(.13)	(.16)	(.12)
	.82	15.84	11.74	11.66	10.45	14.33	14.12	11.30	13.08	13.66	13.25	13.92
			(.26)	(.26)	(.34)	(.09)	(.11)	(.29)	(.17)	(.14)	(.16)	(.12)
	.80	17.02	12.70	12.61	11.18	15.36	15.15	12.14	13.96	14.65	14.22	14.93
			(.25)	(.26)	(.34)	(.10)	(.11)	(.29)	(.18)	(.14)	(.16)	(.12)
5% Inflation $1 Can. =	$.86 US	13.59	9.57	9.50	8.32	12.10	11.92	9.13	10.75	11.48	11.12	11.73
			(.30)	(.30)	(.39)	(.11)	(.12)	(.33)	(.21)	(.16)	(.18)	(.14)
	.84	14.69	10.47	10.41	9.04	13.07	12.89	9.88	11.58	12.41	12.02	12.68
			(.29)	(.29)	(.38)	(.11)	(.12)	(.33)	(.21)	(.16)	(.18)	(.14)
	.82	15.84	11.41	11.34	9.77	14.07	13.88	10.64	12.43	13.36	12.95	13.65
			(.28)	(.28)	(.38)	(.11)	(.12)	(.33)	(.22)	(.16)	(.18)	(.14)
	.80	17.02	12.38	12.32	10.51	15.09	14.89	11.43	13.30	14.34	13.91	14.65
			(.27)	(.28)	(.38)	(.11)	(.12)	(.33)	(.22)	(.16)	(.18)	(.14)
10% Inflation $1 Can. =	$.86 US	13.59	9.37	9.32	7.89	11.91	11.75	8.70	10.28	11.26	10.90	11.54
			(.31)	(.31)	(.42)	(.12)	(.13)	(.36)	(.24)	(.17)	(.20)	(.15)
	.84	14.69	10.28	10.22	8.61	12.87	12.71	9.46	11.10	12.18	11.80	12.48
			(.30)	(.30)	(.41)	(.12)	(.13)	(.36)	(.24)	(.17)	(.20)	(.15)
	.82	15.84	11.17	11.10	9.34	13.86	13.69	10.22	11.94	13.12	12.70	13.45
			(.29)	(.30)	(.41)	(.12)	(.14)	(.36)	(.25)	(.17)	(.20)	(.15)
	.80	17.02	12.08	12.07	10.08	14.89	14.70	11.01	12.80	14.09	13.67	14.44
			(.29)	(.29)	(.41)	(.13)	(.14)	(.35)	(.25)	(.17)	(.20)	(.15)

TABLE 5.5

Pulp IRORs and effective tax rates: Quebec cost structure

	Tax System	0	1	2	3	4	5	6	7	8	9	10
0% Inflation $1 Can. =	$.86 US	14.31	10.51	10.43	9.49	12.98	12.79	10.29	11.93	12.38	12.03	12.61
			(.26)	(.27)	(.34)	(.09)	(.11)	(.28)	(.17)	(.13)	(.16)	(.12)
	.84	15.40	11.39	11.31	10.18	13.95	13.75	11.02	12.76	13.30	12.90	13.55
			(.26)	(.26)	(.34)	(.09)	(.11)	(.28)	(.17)	(.14)	(.16)	(.12)
	.82	16.53	12.31	12.22	10.89	14.94	14.73	11.76	13.60	14.25	13.82	14.52
			(.25)	(.26)	(.34)	(.10)	(.12)	(.29)	(.18)	(.14)	(.16)	(.12)
	.80	17.71	13.26	13.17	11.62	15.97	15.75	12.53	14.47	15.23	14.78	15.52
			(.25)	(.26)	(.34)	(.10)	(.11)	(.29)	(.18)	(.14)	(.17)	(.12)
5% Inflation $1 Can. =	$.86 US	14.31	10.16	10.09	8.80	12.73	12.55	9.59	11.30	12.09	11.65	12.35
			(.29)	(.29)	(.38)	(.11)	(.12)	(.33)	(.22)	(.16)	(.19)	(.14)
	.84	15.40	11.05	10.99	9.50	13.69	13.50	10.36	12.11	13.00	12.60	13.28
			(.28)	(.29)	(.38)	(.11)	(.12)	(.33)	(.21)	(.16)	(.18)	(.14)
	.82	16.53	11.99	11.92	10.21	14.67	14.48	11.11	12.95	13.94	13.52	14.24
			(.27)	(.28)	(.38)	(.11)	(.12)	(.33)	(.22)	(.16)	(.18)	(.14)
	.80	17.71	12.96	12.89	10.95	15.69	15.49	11.89	13.81	14.90	14.46	15.24
			(.27)	(.27)	(.38)	(.11)	(.12)	(.33)	(.22)	(.16)	(.18)	(.14)
10% Inflation $1 Can. =	$.86 US	14.31	9.96	9.91	8.37	12.54	12.37	9.20	10.82	11.86	11.49	12.15
			(.30)	(.31)	(.41)	(.12)	(.14)	(.36)	(.24)	(.17)	(.20)	(.15)
	.84	15.46	10.84	10.77	9.07	13.49	13.31	9.94	11.62	12.76	12.37	13.08
			(.30)	(.30)	(.41)	(.13)	(.14)	(.36)	(.25)	(.17)	(.20)	(.15)
	.82	16.53	11.71	11.64	9.79	14.47	14.28	10.70	12.44	13.69	13.28	14.03
			(.29)	(.30)	(.41)	(.12)	(.14)	(.35)	(.25)	(.17)	(.20)	(.15)
	.80	17.71	12.61	12.53	10.52	15.48	15.29	11.47	13.29	14.65	14.22	15.02
			(.29)	(.29)	(.41)	(.13)	(.14)	(.35)	(.25)	(.17)	(.20)	(.15)

TABLE 5.6

Pulp IRORs and effective tax rates: U.S. cost structure

Tax System	0	1	2	3	4	5	6	7	8	9	10
0% Inflation	14.29	10.61 (.257)	10.53 (.263)	9.65 (.324)	13.35 (.0657)	13.09 (.0839)	10.52 (.264)	12.38 (.13)	12.68 (.11)	12.27 (.14)	12.85 (.10)
5% Inflation	14.29	10.25 (.282)	10.19 (.287)	8.95 (.374)	13.10 (.083)	12.86 (.100)	9.85 (.310)	11.75 (.18)	12.39 (.13)	11.98 (.16)	12.60 (.12)
10% Inflation	14.29	10.00 (.30)	9.99 (.30)	8.51 (.404)	12.91 (.0966)	12.68 (.113)	9.42 (.34)	11.27 (.21)	12.15 (.15)	11.72 (.18)	12.39 (.13)

thus 3.13. When the comparison is between Canadian and U.S. locations, the magnitude of the absolute pre-tax cost effect is extremely sensitive to the value of the Canadian dollar *vis-à-vis* the U.S. dollar. The absolute pre-tax cost advantage of a Canadian location declines as the value of the Canadian dollar increases relative to the U.S. dollar, and at some value of the Canadian dollar it becomes negative. In this section, we assume a value of $1 Canadian = $.82 U.S.; analysis of exchange rate induced effects is left for the following section.

Tables 5.1 to 5.6 demonstrate that in the production of both newsprint and market pulp an Ontario location has an absolute pre-tax cost advantage over a southern U.S. location. In the case of newsprint, as was shown above, the advantage is 3.13; in the case of pulp, it is 1.55. Relative to a Quebec location, an Ontario location has an absolute cost disadvantage in the production of newsprint of 3.79 and a disadvantage in the production of market pulp of 0.51.

One of the major questions addressed in this section is how various tax systems alter the after-tax profitability of investments. In general, the corporate tax system in a given region modifies the locational advantage or disadvantage inherent in that region. In particular, a region with a pre-tax absolute cost advantage over another region may, under a given tax regime, have a greater or lesser after-tax advantage. We are interested in determining both how a change in a corporate tax system in a given region affects the profitability of investment in that region and how profitability would be affected if the same tax system were imposed across all regions. For example, we want to determine whether the Canada–Ontario corporate tax system is more or less onerous in a given situation than the Canada–Quebec system or the southern U.S. system.

A comparative analysis of tax-induced effects requires the delineation of five separable components: the absolute pre-tax cost effect defined above, the after-tax cost effect, the asset-mix effect, the rate-drift effect, and the tax-system effect. The after-tax cost effect is the absolute pre-tax cost effect, multiplied by 1 minus the prevailing effective marginal tax rate. Given any pre-tax IROR, the asset mix effect is the change in the after-tax IROR that arises purely in response to a change in the composition of capital assets. The asset-mix effect arises because different types of assets are accorded different depreciation treatments for tax purposes. The rate-drift effect is the change in the effective marginal tax rate that occurs in a given corporate tax system when the pre-tax IROR is allowed to vary. It is caused by the fact that corporate tax systems are not characterized by constant (flat) effective tax rates. Finally, the tax-system effect is the change in the after-tax IROR that occurs when a switch is made from one tax system to another, after the asset-mix and rate-drift effects have been accounted for.

As an example of the above concepts, consider the situation that arises, given the pre-1981 corporate tax environments, if an Ontario newsprint producer is

subject to the U.S. rather than the Canada–Ontario corporate tax system. If we assume that we are dealing with an old firm, as defined above, the after-tax cost effect equals the absolute pre-tax cost effect times the difference between 1 and the Ontario effective rate. Thus the after-tax cost effect is 3.13 X (1 – .0629) or 2.93. If the Ontario producer were located in the southern U.S. but subject to the Ontario tax system, the after-tax rate of return would equal the after-tax rate of return in Ontario (19.35) less the after-tax cost effect (2.93), or 16.42. This result implicitly assumes that the effective tax rate within a given tax system is constant across all levels of net income and, in this specific example, that production in the southern U.S. uses the same asset mix as production in Ontario. Neither assumption is correct.

As we indicated in Chapter 2, a location in the southern U.S. requires a slightly larger ratio of machinery and equipment to structures than does an Ontario location. Given that tax systems are non-neutral in the treatment of different classes of assets, and given identical variable cost and revenue streams, different asset mixes will give rise to non-identical IRORs and effective tax rates. Owing to the fact that machinery and equipment are accorded a more liberal front-end tax treatment, especially in Canada, than are structures, a firm is subject to a lower after-tax IROR (and thus a higher effective tax rate) if it operates with the Ontario rather than the U.S. capital mix. We have computed a number of equations that directly incorporate the asset-mix effect. In all cases, the asset-mix effect has the correct sign but is very small—around 0.004 percentage points.

The effective tax under a given tax system, is not constant across all levels of net income. Under the pre-1982 Canada–Ontario and Canada–Quebec tax systems as they apply to new firms (columns 1 and 2 in Tables 5.1–5.6), the effective tax rate declines as the IROR increases.[7] Under all other tax systems (columns 3–10 in Tables 5.1–5.6), the effective tax rate increases as the IROR increases.[8] In our example, we can easily correct for the asset-mix and rate-drift effects. Switching to the U.S. mix and IROR levels means moving from the Ontario effective tax rate to the U.S. effective tax rate arising from the Ontario tax system (.0525). Given that the after-tax return of 16.42 equals the pre-tax U.S. IROR of 17.52 times the difference between 1 and the Ontario effective tax rate, we can correct for the asset-mix and rate-drift effects by substituting the U.S. effective tax rate with the Ontario tax system (.0525) for the Ontario effective tax rate (.0629). In this instance, 17.52 x (1 – .0525) = 16.60. The asset-mix and rate-drift effects equal 16.60 – 16.42, or .18. The asset-mix effect, we argued above, is relatively small (.004); thus most of the .18 percentage points can be ascribed to the rate-drift effect.

The tax-system effect has been defined as the change in the after-tax rate of return that occurs when we switch from one tax system to another, after the asset-mix and rate-drift effects have been accounted for. For example, a switch

from the Ontario to the U.S. tax system (from column 4 to column 6 in Table 5.3) reduces the after-tax rate of return from 16.60 to 12.78. Thus the tax-system effect is –3.82.

Tables 5.7 and 5.8 summarize information on the above effects for newsprint and market pulp for a number of cross-tax-system comparisons. All comparisons have been made with the Canadian dollar set at $.82 U.S. and an inflation rate of zero. Column 4 in Tables 5.7 and 5.8 shows the after-tax cost effect that results from the change from an Ontario location to a southern U.S. or Quebec location, assuming that the Ontario tax system is in place in both locations. Column 5 details the adjustment required for the asset-mix and rate-drift effects. (In Ontario–Quebec comparisons, there is no asset-mix effect; consequently the adjustment results from differing effective tax rates caused by the rate-drift effect.) Column 6 shows the pure tax-system effect: the effect of switching from one tax system to another after adjustments have been made for asset-mix and rate-drift effects.

The results summarized in Tables 5.7 and 5.8 clearly show that the Ontario corporate tax system that was in place before 1982 produces lower effective tax rates than any of the other systems analysed in this study and thus drives a smaller wedge between before-tax and after-tax rates of return.

The most dramatic difference between tax treatments arises from a comparison of the position of an old firm under the pre-1981 U.S. corporate tax system (column 6 in Table 5.1–5.6) with the position of an old firm under the pre-1982 Ontario corporate tax system (column 4 in Tables 5.1–5.6). After all adjustments have been made for asset-mix and rate-drift effects, a switch from the Ontario system to the U.S. system imposes a disadvantage on the firm of 3.82 in the case of newsprint and 2.83 in the case of market pulp. It should be noted that although the nominal or statutory tax rates of the two systems are relatively similar, the effective tax rates are very different: the effective tax rate under the pre-1981 U.S. system is three to four times larger than the effective rate under the pre-1982 Ontario system. This difference is almost exclusively attributable to the manner in which firms are allowed to claim depreciation under the two systems: the pre-1982 Ontario corporate tax regime permits a 50 per cent straight-line write-off of machinery and equipment, whereas the pre-1981 U.S. tax regime permits only minimal acceleration. The difference between the effective tax rates of the two systems is reduced when we consider the position of a new firm under both tax regimes (columns 1 and 3 in Tables 5.1–5.6). The reason for this reduction is simply that a new firm, by definition, is not able to take full advantage of the up-front tax incentives embedded in the pre-1982 Ontario system. However, the tax system effects are still relatively large: 1.57 for newsprint and .96 for market pulp (column 6, Tables 5.7 and 5.8).

The results reported in Tables 5.1–5.8 show clearly that the pre-1982 Ontario

TABLE 5.7

Location and tax-system effects: newsprint

1	2	3	4	5	6
1–2	20.65	−3.79	−2.90	−.169	+ .15
1–3	20.65	+3.13	+2.39	−.150	+1.57
4–5	20.65	−3.79	−3.55	−.540	+ .38
4–6	20.65	+3.13	+2.93	−.180	+3.82
4–7	20.65	+3.13	+2.93	−.180	+1.38
4–8	20.65	—	—	—	+1.05
4–9	20.65	−3.79	−3.55	−.160	+1.95
4–10	20.65	−3.79	−3.55	−.160	+ .99
6–7	17.52	—	—	—	−2.44
8–7	20.65	+3.13	+2.77	−.160	+ .47
8–9	20.65	−3.79	−3.36	−.180	+ .69
8–10	20.65	−3.79	−3.36	−.180	− .27

Column
1 Tax system comparison
2 Pre-tax IROR in initial location
3 Pre-tax cost effect
4 After-tax cost effect
5 Asset-mix/rate-drift effect
6 Tax-system effect

TABLE 5.8

Location and tax-system effects: pulp

1	2	3	4	5	6
1–2	15.84	− .69	− .51	−.060	+ .09
1–3	15.84	+1.55	+1.15	−.020	+ .96
4–5	15.84	− .69	− .62	−.001	+ .21
4–6	15.84	+1.55	+1.40	−.422	+2.83
4–7	15.84	+1.55	+1.40	−.422	+ .97
4–8	15.84	—	—	—	+ .67
4–9	15.84	− .69	− .62	−.001	+1.12
4–10	15.84	− .69	− .62	−.001	+ .42
6–7	14.29	—	—	—	−1.86
8–7	15.84	+1.55	+1.33	−.350	+ .30
8–9	15.84	− .69	− .59	− 0	+ .43
8–10	15.84	− .69	− .59	− 0	− .27

Column
1 Tax system comparison
2 Pre-tax IROR in initial location
3 Pre-tax cost effect
4 After-tax cost effect
5 Asset-mix/rate-drift effect
6 Tax-system effect

tax system produces lower effective tax rates for both old and new firms than does the pre-1981 Quebec system. A switch from the Ontario to the Quebec system reduces, marginally, the advantage that a Quebec location enjoys. For newsprint, the tax system effect is .38 for an old firm and .15 for a new firm. For market pulp, the appropriate figures are .21 and .09.

It was shown in Chapter 4 that the corporate tax environments in Canada and the U.S. have changed considerably since 1980. The methodology developed in this chapter allows us to perform a comparative analysis of the effect of these changes on the profitability of investment projects in each of the three locations.

The most radical effect was caused by the introduction of ACRS in the U.S. in 1981 (column 7, Tables 5.1–5.6). The shortening of asset lives for depreciation purposes, together with the increase in the value of the ITC, caused a dramatic drop in effective tax rates and — as we said earlier in this chapter — eliminated the distinction between old and new firms. A comparison of results for the pre-1981 U.S. tax system with results for ACRS indicates that ACRS has reduced the effective tax rates of old firms by approximately half. For an old firm located in the U.S., ACRS has increased after-tax IRORs by 2.44 for newsprint and 1.44 for market pulp. For a new firm, ACRS has increased IRORs by 3.88 and 2.63.

ACRS has considerably reduced the after-tax disadvantage of a U.S. location relative to a location in Ontario. For an old firm producing newsprint, the tax-system effect of moving from Ontario to the U.S. under the pre-1981 U.S. system was +3.82, whereas the move from Ontario to the U.S. under ACRS yields a tax-system effect of only +1.38. For market pulp, the appropriate tax-system effects are +2.83 and +.97.

The introduction in late 1981 of the half-year depreciation convention has greatly reduced the up-front tax advantages to old firms of the Canadian federal corporate tax system, especially in the treatment of machinery and equipment. As was shown in Chapter 3, Ontario has not adopted the half-year convention, whereas Quebec has. In consequence, we would expect a greater increase in effective tax rates in Quebec than in Ontario. An analysis of the results given in Tables 5.1–5.6 confirms this expectation. A comparison of the pre-1981 Ontario tax system (column 4 in Tables 5.1 and 5.3) with the system incorporating a half-year convention at the federal level (column 8 in Tables 5.1 and 5.3) shows that for an Ontario-located producer of newsprint, the effective tax rate almost doubles. The tax-system effect is +1.05. For a producer of market pulp, the effective tax rate increases from .09 to .14 and the tax-system effect is +0.67. The application of the half-year convention by the Province of Quebec leads to even larger tax-system effects: +1.95 for newsprint and +1.12 for market pulp. Another way of looking at this is to consider what happens if the present Quebec corporate tax system is imposed in Ontario. In this case, effective tax rates in

Ontario increase from .11 to .14 for newsprint (columns 8 and 9 in Table 5.1) and from .14 to .16 for market pulp (columns 8 and 9 in Table 5.4).

ACRS and the Canadian half-year convention have greatly reduced the advantages of the Ontario corporate tax environment relative to the U.S. environment. Under the pre-1981 regime, a switch to a U.S. location from Ontario produced a tax-system effect of +3.82 for newsprint and +2.83 for market pulp. A switch from the present Ontario system (with a half-year convention at the federal level) to ACRS produces tax-system effects of only +.47 for newsprint and +.30 for market pulp.

For the 1982 tax year, Quebec reduced the corporate tax rate on qualifying income from 13 per cent to 8 per cent.[9] Results for the Quebec system incorporating the half-year convention and the 8 per cent rate are given in column 10 of Tables 5.1 to 5.6. Before the rate was changed, a move from the Ontario to the Quebec tax system produced a tax-system effect in favour of Ontario. The reduction in the Quebec corporate rate reversed the situation: the Quebec tax environment now yields a marginally lower effective tax rate than does the Ontario environment.

Within the range of IRORs examined in this study, the Ontario policy of not adopting a half-year convention and not reducing the allowable depreciation stream by the value of the ITC is equivalent, for an old firm, to a reduction in the nominal Ontario corporate tax rate of approximately 4 points. It must be emphasized that the 4-point equivalence does not hold over all IROR levels, owing to non-constant effective tax rates.

Ontario and Quebec have both introduced rate changes for the 1983 tax year. The rate in Ontario has increased by 1 point and the Quebec rate has declined by 2.5 points. In addition, a liberatization of the rules governing the claiming of the ITC was announced in the 1983 federal budget. We have simulated all three of these changes for the case of a newsprint producer and report them in Table 5.9. The ITC liberalization has no impact on the tax treatment of old firms, so our simulations are restricted to the tax treatment of new firms.

The effect of the 1-point increase in the Ontario rate on a producer located in Ontario is given in column 1. For comparative purposes, the results obtained in column 8 of Table 5.1 (the 1982 Ontario tax system) are reproduced in column 2. It can be seen that the 1-point increase in the tax rate causes the effective tax rate to increase marginally, from .11 to .12. Column 3 simulates the Quebec 2.5-point rate reduction by applying the Quebec tax system to an Ontario location. It can be clearly seen that the Quebec system produces a much lower effective tax rate than does the Ontario tax system (.085 versus .12). A simulation of the Quebec system with the rate reduction applied to a Quebec location is shown in column 4. The reduction in the corporate tax rate reduces the effective tax rate from .11 (column

TABLE 5.9

Newsprint IRORs: 1983 tax changes

	1	2	3	4	5	6
$1 Can. = $.86 U.S.	16.11	16.23	16.74	20.92	14.08	13.70
	(.11)	(.11)	(.08)	(.05)	(.22)	(.25)
$.84	17.12	17.24	17.80	21.90	15.00	14.64
	(.12)	(.11)	(.08)	(.06)	(.22)	(.25)
$.82	18.17	18.30	18.89	22.93	15.96	15.67
	(.12)	(.11)	(.08)	(.06)	(.22)	(.24)
$.80	19.25	19.39	20.30	24.00	16.96	16.75
	(.12)	(.12)	(.08)	(.07)	(.23)	(.24)

10 in Table 5.2) to .06. The effects of the liberalization of the ITC for a new firm located in Ontario and subject to the Ontario tax system are given in columns 5 and 6. Column 5 shows what the effects of the liberalization would have been if the 1982 corporate tax rate had been retained, and column 6 combines the effects of the liberalization and the 1983 corporate tax rate. It is apparent that the change in the rules governing the claiming of the ITC has a relatively minor effect on the after-tax position of a new firm: given the 1982 Ontario rate of 13 per cent, the after-tax IROR increases by only .14 relative to the IROR reported in column 1 Table 5.1. The inclusion of the 1-point increase in the Ontario rate more than offsets the gain from the ITC liberalization.

The effective tax rates derived in this chapter for the Ontario and Quebec tax systems are significantly below those reported in other studies. Tarasofsky, Roseman, and Waslander (1980), for example, suggest that over the period 1947–76 real effective tax rates for the Canadian manufacturing sector have been relatively close to the statutory rates. At this point it must be emphasized that the effective tax rates reported in this chapter are (real) marginal effective corporate tax rates and are not directly comparable to the average effective tax rates reported in studies such as the one by Tarasofsky and his colleagues. Fullerton and Henderson (1983) measure average and marginal effective tax rates for eighteen U.S. industries and show that there is almost no resemblance between the two sets of rates. Fullerton (1984) offers eleven distinct reasons why marginal and average effective corporate tax rates will differ. One of the major reasons for the difference is that changes in tax laws affect deductions for new (marginal) investments without affecting deductions for previous (existing) investments.

It is interesting to note that Gravelle (1982) reports marginal effective corporate tax rates for both the pre-1981 and ACRS U.S. tax systems that are almost identical to those reported in this chapter. Using a 6 per cent inflation rate,

Gravelle shows effective tax rates for manufacturing industries of 19.1 per cent under ACRS and 36.8 per cent under the pre-1981 tax system—rates remarkably similar to those derived in this study for a 5 per cent inflation rate.

The central conclusions that emerge from our analysis of before-tax and after-tax rates of return are as follows:

1. Given an exchange rate of $1 Canadian = $.82 U.S., pre-tax IRORs for producers located in Ontario are higher than those prevailing in the southern U.S. but lower than those prevailing in Quebec.

2. A comparison of after-tax IRORs shows that the pre-1982 Ontario corporate tax system drove a smaller wedge between before and after-tax IRORs than any of the alternative systems and was significantly more generous than the pre-1981 U.S. corporate tax system. In consequence, after-tax IRORs for an Ontario location were considerably higher than those prevailing in the southern U.S., but lower than those prevailing in Quebec.

3. The introduction of ACRS in the U.S., coupled with the introduction of a half-year depreciation convention in Canada, has greatly reduced the advantages of the Ontario tax system *vis-à-vis* the U.S. system, with the result that Ontario producers now enjoy only a very marginal tax-system effect. Given an exchange rate of $1 Canadian = $.82 U.S., an Ontario location still yields producers of newsprint and market pulp higher after-tax IRORs than does a southern U.S. location. However, after-tax IRORs for producers located in Quebec are larger than those earned in Ontario.

EXCHANGE RATE SENSITIVITY

The before-tax and after-tax IRORs reported for Ontario and Quebec locations in Tables 5.1 to 5.6 are extremely sensitive to fluctuations in the value of the Canadian dollar relative to the U.S. dollar. Since all output is assumed to be sold at prices that are determined in U.S. funds, an increase in the value of the Canadian dollar relative to the U.S. dollar will decrease the total revenue of producers located in Canada. In consequence, appreciation of the Canadian dollar will lead to a decline in the profitability of Canadian locations.

It was shown in the previous section that at an exchange rate of $1 Canadian = $.82 U.S. a producer of newsprint or market pulp located in Ontario enjoys both an absolute pre-tax cost advantage over a producer located in the southern U.S. and, with 1982 tax systems in place, a higher after-tax IROR. As the Canadian dollar appreciates, both before-tax and after-tax rates of return earned by produc-

ers in Ontario decline. Table 5.1 shows that when the value of the Canadian dollar is $.82 U.S. a newsprint producer located in Ontario earns a before-tax IROR of 20.65 (column 0) and an after-tax IROR of 18.30 (column 8). Both IRORs are higher than those yielded by a U.S. location; that is, 17.52 and 15.22 (Table 5.3, columns 0 and 7). If the value of the Canadian dollar were to increase to $.86 U.S., the before-tax rate of return would fall to 18.20 and the after-tax rate of return to 16.23.

An Ontario newsprint producer's locational advantage over a U.S. producer would be completely eradicated if the value of the Canadian dollar rose to $.87 U.S. At this exchange rate, the pre-tax rates of return in the two locations would be the same. However, Ontario producers have a small tax system advantage over U.S. producers, and so the after-tax rate of return in Ontario would be marginally higher than the rate prevailing in the southern U.S. If the Canadian dollar were set at $.88 U.S., an Ontario newsprint producer would earn a lower before-tax IROR than a southern U.S. producer but an identical after-tax IROR. Any increase in the value of the Canadian dollar above $.88 U.S. would reduce after-tax IRORs attributable to an Ontario location to less than those prevailing in the southern U.S. An Ontario market pulp producer's locational and tax advantages would both be neutralized at an exchange rate of $1 Canadian = $.85 U.S. Any value of the Canadian dollar in excess of $.85 U.S. would lead to after-tax IRORs in Ontario lower than those in the southern U.S.

The before-tax and after-tax IRORs of producers located in Ontario are very elastic with respect to exchange rate movements. For newsprint producers, the elasticity of before-tax IRORs to movements in the value of the Canadian dollar over the range $.82 U.S. to $.86 U.S. would be +2.68 and the elasticity for after-tax IRORs would be +3.6. For market pulp producers, the comparable elasticities would be +3.2 and +3.12.

An increase in the value of the Canadian dollar from $.82 U.S. to $1 U.S. would have a dramatic effect on the profitability of producers located in Ontario. For a newsprint producer, the before-tax IROR would drop from 20.65 to 10.77 and the after-tax IROR from 18.30 to 9.70. The respective elasticities would be +3.18 and +3.10. For a market pulp producer, the before-tax IROR would drop from 15.84 to 7.5, yielding an elasticity of +3.6, and the after-tax IROR from 13.66 to 6.4, for an elasticity of +3.65.

The extreme sensitivity of before-tax and after-tax IRORs to exchange rate fluctuations, as indicated by the large elasticities reported above, is due to the way in which changes in the value of the Canadian dollar affect new operating revenue. Because output is sold at prices that are denominated in U.S. funds, any appreciation of the Canadian dollar will cause the total revenue received by a Canadian producer to decline. Because total operating costs are denominated in

Canadian dollars, net operating revenue will decline as the Canadian dollar appreciates and increase as the Canadian dollar depreciates. If both cost and revenue streams were equally effected by exchange rate movements, the IROR elasticities would be +1. Because only the revenue stream is altered by exchange rate movements, the elasticities are substantially greater than +1.

EFFECTIVE TAXATION, CASH FLOW CONSTRAINTS, AND INFLATION

Two observations of public policy interest that emerge from the results in Tables 5.1 through 5.6 relate to (a) the relationship between effective corporate tax rates and the new firm/old firm dichotomy, and (b) the interaction between effective corporate tax rates and expected inflation rates.

Old firms, as we defined them earlier, are firms that undertake new newsprint mill or pulpmill projects in a context of existing cash flows and tax liabilities large enough to permit them to take full advantage of statutory capital consumption allowance provisions and investment tax credit provisions. New firms, by contrast, are firms whose investment in one or the other of the two projects represents their entry into pulp and paper production: they have no existing cash flows or tax liabilities when they make their initial investments in a greenfield newsprint or sulphate pulp mill. For these firms, capital consumption allowances and/or investment tax credits will have to be postponed.

The computer program applied to equations 2 and 4 constrains the rate at which the new firm claims its capital consumption allowances and investment tax credits within the cash flow and tax liability constraints set by the new project itself. This 'project basis' works as follows. For the investor in a new mill, the essential logic is to postpone taxes for as long as possible in order to maximize the project's after-tax IROR. The computer program begins by claiming capital consumption allowances as fast as cash flows allow, thus reducing tax liabilities to zero for as long as possible. Once taxes begin to appear, the investment tax credit is claimed in accordance with the particular tax system rules described in Chapter 4. Most of the tax systems require firms to claim the entire ITC within five years of the initial investment. If this interval expires before the full claim is exhausted, the program adjusts capital consumption allowances in the final years of the five-year claim interval, shunting the allowances into later years, creating tax liabilities and ITC claims earlier, and comparing the resulting after-tax IRORs with the after-tax IROR obtained prior to this shunting process. The shunting process ends when the after-tax IROR has been maximized. This, in turn, represents the most advantageous time-flow of capital consumption allowances and tax credit claims for the firm operating on a 'project basis'.

The empirical results for the zero inflation rate cases indicate that most of the

tax systems discriminate significantly against new firms in terms of effective tax rates. Under the pre-1982 Canadian tax systems (columns 1, 2, 4, and 5 in Tables 5.1–5.6), and under the Ontario cost structure, newsprint projects initiated by old firms experience effective tax rates in the range of 6 to 8 per cent, depending upon the exchange rate. For new firms, the comparable effective rates range from 23 to 25 per cent. Both new firms and old firms encounter slightly higher effective tax rates under the same tax systems for newsprint projects initiated under the Quebec or the U.S. cost structures. For kraft pulp projects, the pre-1982 Canadian tax systems produce effective tax rates in the 7–11 per cent range for old firms and in the 25–27 per cent range for new firms. Within each category of firm, effective tax rates for pulp projects are always higher then effective tax rates for newsprint projects, other things being equal. The higher rates reflect the greater relative investment in buildings (which are subject to slower statutory depreciation rates than machinery and equipment) required for pulp production. This differential tax treatment tends to distort investment away from structures and toward machinery and equipment (see Hulten and Wykoff 1981).

Under the pre-1981 U.S.–Alabama tax system (columns 3 and 6), old firms experience effective tax rates on newsprint projects of 27–30 per cent, depending upon the regional cost structure and the exchange rate. New firms initiating the same projects would experience effective tax rates of 33–35 per cent. So while the pre-1981 U.S. tax treatment discriminates against new firms in terms of effective taxation, it is much less discriminatory in this regard than the pre-1982 Canadian system.

In 1981, the United States shifted to the ACRS approach (column 7), under which firms that generate statutory tax credits exceeding their own tax liabilities are allowed to sell these claims to other firms. In a perfect market, firms generating marketable tax credits should be able to recover their full dollar value; thus ARCS eliminates the new firm cash flow and tax liability constraints that characterize the other tax systems in the tables. The effective tax rates under ACRS apply to both old and new firms. These rates are in the range of 13–17 per cent for the newsprint project and 13–18 per cent for the pulp project.

The introduction of the ACRS approach in the U.S. not only removed the old firm/new firm dichotomy; it also lowered effective tax rates in general for investments subject to U.S. taxes (compare columns 3 and 6 with column 7). New firms experienced the largest decline in effective taxation. Tax relief was, of course, the stated purpose of the Reagan administration's corporate tax changes.

In 1982, the Canadian federal government moved to a half-year convention in computing capital consumption allowances, an approach that had been standard practice in the U.S. for some years (see Chapter 4). Columns 8 and 9 report the effect on old firms of this less generous treatment of capital consumption.

Relative to the pre-1982 Canadian tax systems, the half-year convention lowers old firms' after-tax IRORs by approximately 1 percentage point and increases their effective tax rates from 5–7 per cent to 10–11 per cent for newsprint projects and from 9–10 per cent to 13–14 per cent for kraft pulp projects. Within the range of exchange rates used in the tables, new firms are not affected by the half-year convention. Their cash flow constraints prevent them from claiming as much as 25 per cent of capital costs in the first year of operation in any case, and therefore the half-year convention does not lower the after-tax IRORs reported in columns 1 and 2. In short, the new half-year convention has narrowed the effective tax gap between new firms and old firms by raising the effective tax rates faced by the latter.

Again in 1982, the Quebec government lowered its corporate tax rate to 8 per cent. Column 10 shows the effect of this change on old firms. After-tax IRORs for old firms that initiate projects under the Canada–Quebec tax system increase by less than 1 percentage point, and the effective tax rate falls from 13–15 per cent to 10–11 per cent for newsprint projects and from 14–16 per cent to 10–12 per cent for pulp projects. Effective tax rates for new firms locating in Quebec (not reported) fall by 3 to 4 percentage points relative to the figures reported in column 2.

The most important conclusion to be drawn from these new firm/old firm comparisons is that when Canadian coporate tax systems are applied to the pulp and paper industry—and to other industries as well—they discriminate significantly against projects undertaken by new entrants. This barrier-to-entry problem has been eliminated under the ACRS system in the United States. From a public policy perspective, some comparable approach should be adopted in Canada: statutory rates of capital consumption and investment tax credit claims should be freed from the cash flow constraints set by the project itself. Further discussion of this issue is contained in Anderson, Beaudreau, and Bonsor (1983).

As we pointed out earlier in this chapter, North American corporate tax systems also produce interaction between fully anticipated inflation rates and effective tax rates. The lack of indexing of capital consumption claims for old firms and of capital consumption claims and investment tax credits for new firms tends to produce an inverse relationship between inflation rates and real after-tax IRORs. For new firms, however, positive inflation rates also have the effect of slightly relaxing the cash flow constraints that prevent them from taking full advantage of accelerated capital consumption claims and tax credit claims. New firms will still experience a significant negative effect on their after-tax IRORs owing to inflation because they, more than old firms, must postpone their claims.

Given a newsprint project, the pre-1982 Canadian tax systems, and an exchange rate of $.82 U.S., the effective tax rates for an old firm rise from 6–8 per

cent to 9–11 per cent when expected inflation goes from zero to 10 per cent. Under the same assumptions, effective tax rates for a new firm rise from 23–24 per cent to 27–28 per cent. Given a kraft pulp project and the same tax systems and exchange rate, effective tax rates from an old firm rise from 9–12 per cent at stable prices to 12–14 per cent at 10 per cent anticipated inflation. For new firms, the increase is from 25–26 per cent to 29–30 per cent.[10]

Under the pre-1981 U.S. tax system, old firm effective tax rates move from 26–29 per cent to 34–36 per cent as anticipated inflation moves from zero to 10 per cent. With the same rise in inflation, the American ACRS model (applied to U.S. costs) causes effective tax rates to rise with inflation from 13 per cent to 21 per cent.

The introduction of the half-year depreciation convention to the Canadian tax systems alters the Canadian tax system results slightly.

It is clear from these results that while all of the North American tax systems in effect during the 1970s and 1980s produce a positive relationship between anticipated inflation and effective tax rates, the observed size of this relationship depends upon the specifics of each tax system's structure. However, some generalizations are possible. Corporate tax systems that incorporate *highly* accelerated capital consumption allowances tend to insulate effective tax rates from anticipated inflation. This is so because immediate deductibility of capital costs (for an old firm) completely insulates real after-tax IRORs from anticipated inflation. The firm simply enters its capital consumption claim fully (together with any applicable ITC) at the outset, before inflation has a chance to go to work on the real values of these claims. The pre-1982 Canadian tax systems are closer to this model than are the other tax systems considered here, and consequently the sensitivity of old firm effective rates to inflation are lower than they are under the other systems. Another way of insulating after-tax real IRORs against inflation is to simply eliminate all capital consumption allowances while ensuring that investment tax credits are claimed at the outset of the project or not at all. Consider a modified version of equation 4 in which D_t and Z_t are both set equal to zero, so that

$$K_0 = \sum_{t=0}^{40} \frac{(1-T)[S_t - C_0(1+\delta)^t](1+p)^t}{(1+r_p)^t}. \tag{5}$$

Since the definition of the after-tax real rate of return is $[(1+r_p)/(1+p)]-1$, it is clear that this after-tax real rate is invariant to anticipated inflation (p). The pre-1981 U.S. tax system is closer to this ungenerous variant than are the other tax systems, so once again, effective tax rates here are *relatively* insensitive to anticipated inflation.

The U.S. ACRS approach lies somewhere in the middle. It does not provide as

much capital consumption acceleration as the Canadian pre-1982 system, but it offers more acceleration than the pre-1981 U.S. system. Consequently, one expects greater effective tax rate sensitivity to anticipated inflation with this tax system than with those that more nearly approach immediate or zero (completely deferred) capital cost deductibility. This expectation is confirmed for the projects we are examining.

Tables 5.1 through 5.6 illustrate some interaction between the real after-tax IROR disadvantage of new firms relative to old firms and the anticipated rate of inflation. Though inflation does relax the constraints under which the new firm operates in claiming its capital consumption allowances and tax credits, it remains true that the new firm is forced to defer these claims longer than the old firm, thus exposing their real values to the impact of inflation to a greater extent. A sample comparison will serve to illustrate this effect. Consider the greenfield newsprint project undertaken in Ontario with pre-1982 tax systems and a value for the Canadian dollar of $.82 U.S. From Table 5.1, the new firm expects an after-tax IROR of 15.82 with zero inflation, while the old firm expects an after-tax IROR of 19.35. The new firm/old firm after-tax IROR ratio is 15.82/19.35 or .82. At 10 per cent inflation the ratio is 15.00/18.81 or .80. Inflation produces a (small) relative decline in the new firm's after-tax IROR.

To summarize the results of this section, it has been observed that at comparable inflation rates new firms earn lower after-tax IRORs than old firms and therefore face higher effective tax rates. The exception to this result is the U.S. ACRS system with its marketable tax credits. In Chapter 6, we shall translate this observation into a policy recommendation for the Canadian corporate tax system, a recommendation designed to place new firms and old firms on equal footing in this respect. We also noted in this section that fully anticipated inflation reduces expected real after-tax IRORs on the pulp and paper projects examined. This problem can be solved, as others have suggested in discussions of 'inflation accounting', by appropriate indexing of capital consumption allowances and investment tax credit claims that are deferred into periods subsequent to the inception of capital projects. We found, and noted in passing, that effective tax rates on capital projects depend upon the composition of those projects. New pulp mills, for example, pay higher effective tax rates than new newsprint mills because the former more intensively use capital inputs (structures) that are subject to less generous capital consumption allowances. We shall also recommend that this be changed. Finally, new firms tend to suffer from anticipated inflation to a greater extent than old firms. Removal of the tax-induced discrimination between the two kinds of firms would also eliminate this effect.

MODERNIZATION INCENTIVES AND PROFITABILITY

In Chapter 2, we raised the question of the industry's need for public assistance in the form of capital grants. We identified greenfield projects in the newsprint and sulphate pulp sectors as investments that can provide indexes of profitability with which costs of capital can be compared. Our main results supply these profitability indexes in the form of after-tax IRORs. Greenfield newsprint projects undertaken in Ontario offer after-tax IRORs ranging from 16.64 to 20.52 per cent for old firms and from 13.12 to 16.91 per cent for new firms under pre-1982 tax systems (columns 1 and 4 in Table 5.1). Which of these rates actually applies within the range given depends upon the assumed exchange rate and the assumed expected rate of inflation. For example, if the value of the Canadian dollar is $.82 U.S. and the expected inflation rate is 10 per cent, the expected after-tax IROR for the newsprint project is 18.81 per cent for old firms and 15 per cent for new firms. For the pulp project, after-tax IRORs range from 11.91 to 15.36 per cent for old firms and from 9.37 to 12.70 per cent for new firms (columns 1 and 4 in Table 5.4). At a value for the Canadian dollar of $.82 U.S. and an expected inflation rate of 10 per cent, the expected after-tax IROR on the pulp project is 13.86 per cent for old firms and 11.17 per cent for new firms.

How do these results compare with the cost of capital for equity-financed projects in Canada? The answer to this question depends crucially on opinions concerning the 'normal' rate of return on capital investments available in other sectors. Most studies of the rate of return on capital begin with accounting rates of return, which express before-tax or after-tax profits as a ratio of capital invested. If depreciated book values of capital appear in the denominator of this ratio, then profits, including interest on financial liabilities of firms, appears in the numerator. Rates of return on net worth exclude bond interest. Rates of return on common shareholders' equity exclude interest payments and returns to holders of preferred shares. All of these varieties of accounting rates of return suffer from crucial shortcomings compared with an IROR measure.

The nature of these shortcomings has been examined by Fisher and McGowan (1983). Ignoring for the moment the issue of non-zero inflation rates, Fisher and McGowan identify two problems. First, standard accounting rules for determining depreciation on a single project lead to significantly understated values for depreciated capital and tend to inflate accounting rates of profit relative to the project's IROR. When economic depreciation rates are substituted for accounting rates, measured rates of return on capital fall by several percentage points. Second, *ex post* measurements of accounting profit rates over industry aggregates fail to allow for the rate of growth of capital investment. New projects are always adding disproportionately large amounts of undepreciated capital to balance

sheets, a circumstance that tends to raise the denominator in accounting rate of profit calculations, biasing accounting rates downward as estimates of IRORs.[11]

Transforming measured rates of return into real rates of return under inflationary conditions adds further complications. Capital is being carried on balance sheets at historical values, and depreciation based on these historical values understates the amounts needed to effect market value replacement, a problem that applies to circulating capital (cash balances, raw materials, finished inventories) as well as to fixed capital. During periods of rapid inflation, therefore, nominal (measured) rates of return overstate real rates of return.

Researchers who have undertaken the formidable task of transforming measured rates of return into estimates of real IRORs on capital investments report reasonably consistent results for Canada. Jenkins (1977) found that on a before-tax basis, including all taxes as social returns, the real rate of return on capital in Canadian manufacturing lay in the 11–12 per cent range from 1965 to 1974. Tarasovsky, Roseman, and Waslander (1980) measured the before-tax real (private) rate of return on manufacturing capital in Canada over the 1947–76 period at 10–11 per cent. Their real rate of return on net worth came out to just over 14 per cent.[12] The after-tax rates of return for manufacturing reported in their study were 5–6 per cent on capital and 7–8 per cent on net worth. The *ex post* performance of broadly based common stock portfolios implied a real rate of return on diversified equity holdings of about 7 per cent in real terms (e.g., Malkiel 1975).

On the basis of these aggregate studies, hurdle costs of capital seem to be about 11 per cent on a before-tax basis and about 6 per cent on an after-tax basis. When (leveraged) equity investments are considered, the appropriate rates include a risk component and appear to be 1 to 3 percentage points higher.

Required IRORs for individual projects are occasionally reported, and these are sometimes higher than the returns from the aggregate *ex post* studies. For example, companies involved in recent negotiations over tar sands development have required after-tax real rates of return in the 10–11 per cent range (Brandie, Clark, and Wiginton 1982). Similar, if not higher, rates appear to form the basis for rate-setting procedures on regulated transportation modes in Canada.

The after-tax IRORs that we have calculated for Ontario projects using the pre-1982 Canadian tax system—13 to 20 per cent for newsprint and 9 to 15 per cent for pulp—provide satisfactory project rates of return in relation to required rates of return. The upper end of our reported range of IRORs has declined by about 1 percentage point in Ontario with the introduction of the half-year convention in 1982. As we said earlier in this chapter, our results are quite sensitive to the type of tax system used, the old-firm/new-firm distinction, and the assumed exchange rate. But given a value for the Canadian dollar between $.80

and $.86 U.S., projects undertaken in Ontario meet the conventionally assumed required rates of return for the early 1980s.

In the mid-1970s, when the Canadian dollar was at par with the U.S. dollar, this conclusion could not be supported. If the Canadian dollar had been at par in 1982, for example, after-tax newsprint IRORs would have declined to 7–10 per cent and after-tax pulp IRORs would have declined to 3–6 per cent under the pre-1982 tax systems.[13] If the Canadian dollar had been overvalued in 1982 to the same extent that it was over-valued in the mid-1970s, new projects in Ontario would have been marginal investments at best.

The conclusion that early-1980s rates of return in Ontario are satisfactory at present exchange rates does not mean that Ontario is the preferred location for new capacity. The Quebec rates of return are higher. With the half-year convention in place in Ontario and the ACRS system in place in the United States, after-tax IRORs in Ontario are just slightly higher than IRORs in the southern U.S., given a value for the Canadian dollar of $.82 to $.84 U.S. In addition, though we do not derive profitability figures for offshore producers, the appreciation of North American against European currencies in the early 1980s has strengthened the traditionally less competitive positions of Swedish and Finnish producers in particular.

Thus, while Ontario rates of return on new projects exceed capital costs in the early-1980s environment, pressures to increase capacity may not be as strong in Ontario as they are elsewhere, particularly in Quebec. Further, as Chapter 6 explains, Ontario's forest products sector already uses the province's timber base in full. This means that in practice newsprint and kraft pulp projects can only realize the favourable rates of return reported here if older facilities are retired and their timbersheds reallocated to new mills. As Figure 2.1 shows, retirement and complete replacement is an extreme option. Usually, a more appropriate strategy for the industry is the partial replacement and/or extensive renovation of older facilities. But complete replacement is *always* an option (point B in Figure 2.1) and, as we have shown, it is an option that would allow Ontario to use its timber resources at satisfactory rates of return under projections of existing economic conditions.

Since private rates of return on new projects in Ontario can meet capital costs at exchange rates that reflect Canada's overall cost position relative to the United States, modernization incentives are not needed to provide the industry with satisfactory rates of return. This conclusion should not be taken to mean that we would have come out in favour of capital subsidies had our analysis disclosed that private rates of return fall short of capital costs. It is quite consistent to oppose capital subsidies even when private rates of return fall short of the hurdle costs of capital. This issue is taken up in detail in Chapter 6.

TABLE 5.10

Capital incentives and newsprint IRORs (zero inflation)

	(1)	(2)	(3)
$1 Can. = $.86 U.S.	17.15	18.87	19.92
= $.84	18.23	20.05	21.14
= $.82	19.35	21.27	22.41
= $.80	20.52	22.53	23.73

Since the modernization grants applied to renovations of existing facilities, the information needed to assess their likely impact on private rates of return is not available to us. Had several firms in the industry opted for greenfield-style projects, it would have been necessary to greatly increase the capital incentives offered under the program in order to give each applicant a grant equal in percentage terms to the average grant actually paid out to Ontario firms—about 9.5 per cent of project costs. Nevertheless, our new projects do provide some indication of how such capital assistance might have affected after-tax IRORs on greenfield-style investments. Reducing capital costs on the new newsprint project by 9.5 per cent has the effects indicated in Table 5.10. Column 1 reproduces the after-tax IRORs for old firms locating in Ontario from column 4 in Table 5.1. Column 2 shows the results of allowing the firm a 9.5 per cent capital subsidy, assuming the subsidy is non-depreciable and does not receive an investment tax credit. Column 3 assumes that the subsidy forms part of capital costs subject to depreciation allowances and, again, does not receive the ITC. The IRORs in column 2 are about 10 per cent higher than those in column 1. The column 3 IRORs are about 16 per cent higher than the column 1 IRORs. So, depending upon the treatment of the capital grants in the calculation of capital consumption allowances, rates of return are quite responsive to the modernization grants. From the industry's point of view, modernization assistance makes an important contribution to expectations of profitability.

NOTES

1 Anderson, Beaudreau, and Bonsor (1983) reported the effect of an increase in the capital–labour ratio later in the project's time horizon. The additional capital expenditure—an assumed paper machine speed-up—had a negligible impact on the calculated before-tax and after-tax IRORs.

2 The long fibres in northern pulps offer greater strength than the shorter fibres typical of southern pine pulp.

3 The program was run on Lakehead University's computer. Details are available from the authors on request.

4 Just as with stable prices, the real after-tax IROR is r. The real after-tax IROR is $[(1+r_p)/(1+p)] - 1$, as described above. So the effective tax rate is $\left\{r - [(1+r_p)/(1+p)] - 1\right\}/r$.

5 R is simply defined as the level net revenue stream that has the same pre-tax present value (K_0) as the actual non-level net revenue when r is used as the rate of discount.

6 An immediate write-off of all capital costs plus an investment tax credit produces a negative effective tax rate for the old firm if capital consumpton allowances are computed gross of the ITC, as they are in the U.S.

7 The decline in the effective tax rate is due to the fact that, as net income increases, the new firm is able to take greater advantage of front-end tax incentives.

8 The effective tax rate as a function of the IROR yields a U-shaped curve. As net income and the IROR rise, the effective tax rate declines, since the firm can take better advantage of front-end tax breaks. When net income increases past the level necessary to allow the firm to take maximum advantage of all front-end breaks, the effective tax rate begins to rise.

9 The term 'qualifying income' is defined in Chapter Four.

10 It should be noted that, in comparisons between Canada and the U.S. at different assumed rates of inflation for each country, the exchange rate shown in Tables 5.1 to 5.6 is the *initial* exchange rate only. In subsequent periods the value of the Canadian dollar has to be thought of as depreciating at a rate equal to the difference between the Canadian and American rates of inflation.

11 Fisher and McGowan (1983) prove that when accounting rates of return are measured on beginning-of-year assets a rate of growth in the number of (identical) projects equal to the IROR will produce a measured accounting rate of return (using accounting depreciation rules) equal to the IROR itself. The depressing effect of the growth rate on the accounting rate of return taken over all the projects exactly offsets the over-estimation of the IROR by the accounting rate of return on each project. See their Table 2, 86.

12 These figures are simple averages of the annual rates of return shown in their Tables C–1 and C–3.

13 These results have been derived using the assumptions lying behind Tables 5.1 through 5.6, with the exchange rate set at $1 Can. = $1 U.S. instead of in the range of $1 Can. = $.80–.86 U.S.

6
Policy Implications

The previous chapter presented the empirical results we obtained by subjecting new investment projects in the pulp and paper industry to different North American tax systems. These results, reported as before-tax and after-tax internal rates of return and effective tax rates for old and new firms under different inflation assumptions, form the basis for the policy conclusions discussed in the present chapter. The first section of the chapter suggests a number of ways in which Canadian corporate taxation can be improved and relates our results to the findings of other studies. In particular, we discuss the role of the corporate tax system as a barrier to the entry of new manufacturing firms, the related issue of marketable corporate tax credits, the impact of inflation on rates of return, the effect of asset-mix on effective tax rates, and the general problem of too-frequent changes in tax provisions in Canada. The second section uses the generally favourable rate of return results reported for Ontario and Quebec projects as the starting point for a critique of the capital grants offered by the federal and provincial governments to pulp and paper companies after 1979. We find little or nothing to be said in favour of these grants either in terms of the specific profitability position of the pulp and paper industry or on wider grounds of resource allocation in the economy as a whole. The final section examines the prospects for the expansion of pulp and paper capacity in Ontario. Our conclusions in this section are that capacity expansion is subject to severe constraints, that employment is likely to decline, and that adjustment assistance should be extended to workers as labour-saving modernization occurs.

ISSUES IN CORPORATION TAX POLICY

Our comparisons of before-tax and after-tax rates of return on new investments in the pulp and paper sector have shown Canadian effective tax rates to be lower

than U.S. effective tax rates. The introduction of ACRS in the U.S. in 1981 and the spread of the half-year depreciation convention from the U.S. to Canada in 1982 have narrowed but not eliminated the difference in effective corporation tax rates. Although the results given in Chapter 5 are specific to the pulp and paper sector, the available empirical evidence suggests that the effective tax rates derived in this study are fairly representative of manufacturing industries as a whole. Gravelle (1982, 1983) shows that the ratio of machinery and equipment to structures is approximately the same in the capital stocks of the pulp and paper sector and the manufacturing sector as a whole. In addition, effective tax rates, with few exceptions, are stable across manufacturing sub-sectors. The exceptions occur when the ratio of machinery and equipment to structures in a particular industry significantly departs from the average ratio. In industries where the capital stock is heavily weighted toward machinery and equipment, such as the automobile industry, effective tax rates are below average. The differences in effective tax rates across manufacturing sub-industries are primarily caused by the different tax treatments accorded to different types of assets.

Views as to what constitutes an appropriate corporate tax system are bound to vary. Canadian businessmen, for example, tend to see corporate tax policy as an instrument that affects international competition and will, therefore, criticize provisions in the Canadian system that they see as disadvantageous relative to corresponding provisions in the U.S. and other foreign tax systems. The Canadian tax system has long contained industry-specific tax treatments, and representatives of particular industries frequently lobby for tax provisions that would provide them with a more advantageous tax environment. The Canadian Pulp and Paper Association's request for a special industry-specific investment allowance in the mid-1970s (Chapter 2) is a case in point.

Economists argue that if a wedge *is* to be driven between the real before-tax rate of return on investment and the real-after tax return to the corporation, the wedge ought not to distort investment within the corporate sector by imposing different effective tax rates on different assets and different industries. Even though corporate taxation *itself* (the wedge) introduces inefficiencies into the saving–investment process and alters the relationship between the corporate and non-corporate sectors, equal effective tax rates within the corporate sector at least secures the goal that it should not be possible, in the long run, to increase the social value of corporate output by shifting capital from one corporation to another when both experience identical after-tax rates of return. Depending on the nature of the other distortions introduced by the corporate tax wedge, this may be a valid second-best efficiency goal.

If corporations are taxed independently of the industry in which they are situated, what of the argument that overall effective corporate tax rates for all

firms ought to be adjusted to reflect conditions of international competition? For example, if after-tax rates of return in Canada fall below those in the U.S., should Canadian effective tax rates be reduced to compensate for the differential?

In the short run, it is certainly probable that an appreciable change in relative effective tax rates between Canada and the U.S. will produce shifts in investment activity between the two countries in response to the resulting change in relative after-tax rates of return. This is part of the disequilibrium process described in Chapter 1, in which after-tax IROR differences across regions are narrowed by investment shifts in the direction of regions with the highest after-tax rates of return. During the adjustment period, regions or industries with lower rates of return will experience higher unemployment and slower growth. Over the longer run (and in the absence of further changes in relative regional tax rates), relative regional factor prices must adjust to offset differences in effective tax rates if after-tax rates of return are to be restored to similar levels across regions. Once the adjustment process has been completed, and quantity responses (unemployment) have been tranformed into factor price responses, a region's corporate tax system will affect the economy primarily through its impact on the allocation of the region's productive resources.

Given that Canadian governments are going to levy some form of corporate taxation, it is relevant to ask what effect specific corporate tax provisions have on economic efficiency. Our analysis suggests a number of ways in which Canada's corporate tax system reduces efficiency.

First, the application of the Canadian corporate tax system to manufacturing produces effective tax rates that are different across assets and different for the same asset across different firms. The non-neutrality of the system has two fundamentally different causes: depreciation and ITC rates that are not related to economic depreciation, and the old-firm/new-firm distinction. The former source of non-neutrality has been noted in connection with both the pre-1981 and the present U.S. tax systems (Granvelle 1981 and 1982, Feldstein 1981, Hulten and Wykoff 1981). Specifically, the combination of fast write-offs on machinery and equipment and a basically flat-rate ITC produces lower effective tax rates on assets that are short-lived than on assets that are long-lived. It follows that effective tax rates increase as the proportion of structures and other long-lived assets to total assets increases. It was shown in Chapter 5 that different asset mixes lead to different effective tax rates in Canada as well: again effective tax rates in manufacturing increase as the proportion of structures to total capital stock increases. This discrimination between types of assets clearly leads to distortion, since it provides investors with an incentive to favour some types of assets over others.

It was also shown in Chapter 5 that effective tax rates for a given mix of capital

assets depend on the level of a firm's pre-existing net income stream. When this stream is assumed to be zero — the case of a 'new firm' in our model — the firm is able to derive only a small benefit from accelerated depreciation allowances and investment tax credits. The pre-1982 Ontario and Quebec tax systems applied widely different tax rates to projects with the same total variable cost and total revenue streams. A project sponsored by a firm with a zero pre-existing income flow faced an effective tax rate four times greater than the rate faced by an identical project sponsored by a firm with enough pre-existing net income stream to take full advantage of the potential allowances and credits. Even with the half-year depreciation convention incorporated into the model, effective tax rates in Ontario and Quebec for a new firm are approximately double those for an old firm. As the level of the pre-existing net income stream approaches the level required to enable a firm to take maximum advantage of the available up-front tax incentives, the effective tax rate declines.

The introduction of ARCS in the United States in 1981 provided firms with depreciation allowances and investment tax credits that were greatly accelerated relative to the allowances and credits available under the pre-1981 system. U.S. tax authorities recognized that the value of a reduction in effective tax rates depends on the level of the pre-existing cash flow, and in order to eliminate discrimination between old and new firms ACRS was accompanied by the introduction of 'safe harbour' leasing provisions. As we pointed out earlier, safe harbour leasing effectively enables a firm with an inadequate level of shelterable income to obtain the maximum benefit from accelerated depreciation and ITCs by what amounts to selling unused depreciation claims and ITCs to firms that have sufficient tax liability to take full advantage of the claims and credits.[1]

The non-availability of marketable tax credits and claims in Canada dramatically reduces the availability of legislated investment incentives. As Steuerle (1983) notes in connection with the pre-1981 U.S. tax system, investment incentives were given in the form of a reduction in tax liability that could be used only to offset taxes or taxable income. The same point applies to the present Canadian system. In consequence, the investment incentives provided by the Canadian system are effectively denied to three types of companies: new companies starting operations, companies with large investment plans relative to current tax liabilities, and companies with unprofitable current operations but profitable investment opportunities (Galper and Toder 1983). In brief, investment incentives are not available to those firms that, at the margin, need them most. The manner in which the Canadian tax system operates thus creates a very sizable barrier to entry and reduces the contestability of markets, especially in cases where entry requires the presence of large investments in long-lived machinery and equipment (see also Anderson, Beaudreau, and Bonsor 1983).

Allowing depreciation claims and ITCs to be freely bought and sold would eliminate a significant source of distortion from the existing Canadian corporate tax system. At the same time, the introduction of marketable ITCs and depreciation allowances would reduce entry barriers and hence improve contestability. Making investment incentives marketable would maximize the present value of such incentives by making their value to a firm independent of pre-existing income streams. It should be noted that the provision of carry-forwards for the ITC and depreciation allowances is not a substitute for marketability. For example, an ITC of $1 carried forward for seven years at a discount rate of 12 per cent has a present value of only $.45; thus the firm loses over half of the real value of the incentive.

The Canadian corporate tax system also serves to reduce economic efficiency because effective tax rates under the system are sensitive to anticipated inflation. Because depreciation is based on historical cost, inflation reduces the real value of depreciation allowances and thus increases the effective tax rate. The presence of high rates of inflation in the mid-1970s and early 1980s led to many attempts to empirically determine the effect that inflation has on effective tax rates and, as well, to recommendations as to how the corporate tax system should be altered to offset the presence of inflation. For example, Feldstein and Summers (1979) show that for 1977 the use of historic cost depreciation in the presence of inflation in the U.S. caused effective tax rates to increase by 14 per cent.

The pre-1982 Canadian tax system was less exposed to the impact of inflation than either the pre-1981 U.S. tax system or ACRS. We showed in Chapter 5 that, given an increase in the inflation rate from 0 to 10 per cent, the effective tax rate increases less under the pre-1982 Canadian system than under any of the alternative tax systems modelled. It must be noted, however, that in the presence of inflation accelerated depreciation allowances discriminate against structures in favour of shorter-lived assets. Thus effective tax rates will be more susceptible to the effects of inflation in those sectors where structures are a higher proportion of total assets.

Effective tax rates can be made immune to inflation either by indexing depreciation allowances or by moving to an expensing system of depreciation. However, most of the discussion in the public finance literature has concentrated on the relative merits of indexing versus accelerated depreciation allowances. Although indexing is superior to acceleration on efficiency grounds, it is administratively far more complex.

A final source of inefficiency in the corporate tax system in Canada is the frequency with which changes are made both in rates and in the treatment of income for tax purposes. Changes in the corporate tax system have become an annual event, especially at the federal level. Governments effect changes in the

corporate tax rate and structure for both revenue and perceived fiscal policy purposes. Use of the corporate tax system as a vehicle for fiscal policy has centered on attempts to either increase or decrease the flow of investment by altering depreciation allowances or the ITC levels. A considerable body of evidence sugests that investment is sensitive to tax changes, but with a lag. McFetridge and May (1976) have modelled the effect of changes in investment incentives in the Canadian corporate tax system on the volume of investment. They indicate that although investment in machinery and equipment is relatively sensitive to such changes, the modal impact is not reached until the third year following the change. Harman and Johnson (1978) report findings that are essentially similar. The relatively long lag structure implies that the corporate tax system is an inappropriate vehicle for short-term fiscal policy purposes. Even in the absence of a long lag structure, *ad hoc* adjustments to depreciation allowances and to the availability of the ITC may be inherently destabilizing (Feldstein 1981) and may introduce a substantial amount of unnecessary risk into current capital investment decisions.

In recent years, the structure of the corporate income tax has changed with greater frequency in Canada than in the United States. For the most part, changes in the U.S. corporate tax system represent major shifts in tax policy and have been enacted only after very extensive analysis and debate, including simulations of the probable effect of such changes on key economic variables. The frequent changes in the Canadian corporate tax structure have typically been *ad hoc* in nature, and they have not generally been preceeded by widespread or meaningful analysis of the probable effect of the measure on key economic variables. Indeed, institutional budgetary arrangements in Canada have for the most part precluded prior analysis of tax changes. The introduction of the half-year depreciation convention in Canada is a case in point—empirical simulations or even informal debate would have shown that it was a totally inappropriate measure to introduce during a recession.

In summary, our view is that Canada's corporate tax structure should avoid the implicit subsidization of machinery and equipment *relative* to structures through the use of rapid depreciation and ITC incentives skewed to the former.[2] The fact that newsprint projects and pulp projects undertaken at the same location experience different effective tax rates is in part the result of these different tax treatments: since pulpmill projects involve a higher proportion of long-lived structures in their capital expenditure mix than newsprint mills, they are subject to a higher effective rate of taxation. The barrier to entry implicit in the Canadian tax system should be dealt with by making it possible for new firms to claim ITCs and accelerated depreciation allowances as if they had the cash flows of existing enterprises. The introduction of a system of marketable tax credits, such

as the U.S. safe-harbour leasing approach, should solve this problem.

The present degree of acceleration of capital consumption allowances and existing ITC provisions ensure that after-tax IRORs on new investment projects are not seriously harmed by moderate (10 per cent or less) rates of inflation. In Tables 5.1 through 5.6, after-tax rates of return on new investments decline by .4 to .6 percentage points when expected inflation rises from 0 to 10 per cent with Canadian tax systems in place and applied to projects on an old-firm basis. Given the complications involved in indexing capital consumption allowances, we question whether such procedures are worth the trouble of implementation under these circumstances.

As a general matter, frequent changes in the corporate tax system should be avoided, since such changes inject needless uncertainty into investment activity without contributing noticeably to the effectiveness of countercyclical stabilization policy.

An alternative to the present system of income-based corporate taxation that has received attention in the public finance literature is the adoption of a cash-flow tax base.[3] Under this arrangement, the tax base is defined, essentially, as the difference between the cash inflows from the sale of output and real assets and the cash outflows from the purchase of current and capital items. In effect, then, cash-flow taxation of corporate income provides for the expensing of capital assets. It has frequently been shown that a cash-flow approach to the taxation of corporate income is neutral *vis-à-vis* the real decisions taken by firms.[4] As Boadway, Bruce, and Mintz (1982) note, the major advantage of a cash-flow tax base is that it is far simpler to administer than an imputed income base. In particular, it avoids the difficulty, inherent in the income-base approach, of providing an accurate measure of the real rate of economic depreciation of assets.

Adoption of a cash-flow tax base will accentuate rather than eliminate the old-firm/new-firm distinction which arises because a new firm undertaking a substantial capital investment program will be in a negative cash-flow position in the early years and thus will have a negative tax liability. The advantage of moving from the existing depreciation scheme to one that allows a 100 per cent write-off at the time of acquisition is far greater for an old firm than it is for a new firm. As was shown in Chapter 5, new firms derive less benefit from the accelerated depreciation provisions in the Canadian corporate tax system than do old firms, and the difference in benefits is a direct function of the degree of acceleration. Thus the introduction in 1982 of the half-year depreciation convention reduced the degree of acceleration and led to increased effective tax rates for old firms while it left unchanged the effective tax rates faced by new firms.

In order to eliminate the old-firm/new-firm distortion, the adoption of a cash-flow tax base requires either that the government be liable for negative tax

payments (a full loss offset policy) or that firms be able to sell negative tax liabilities in a free market.

THE ECONOMICS OF THE MODERNIZATION GRANTS

The Pulp and Paper Modernization Program introduced in 1979 provided firm-specific capital incentives to eastern Canadian pulp and paper companies. As we said in Chapter 2, this program emerged as a result of the industry's concerns in the mid-1970s that its competitive position relative to U.S. producers had deteriorated to the point at which new capital investments in Canadian locations no longer promised adequate rates of return. In Chapter 5, we examined relative after-tax IRORs in Canadian and U.S. locations in the early 1980s and concluded that private rates of return on new investments in Ontario and Quebec were both high enough to meet hurdle costs of capital and high enough to allow Canadian projects to complete with similar projects undertaken in the southeastern U.S.

The decline in the value of the Canadian dollar that began in 1977 did much to improve prospective after-tax IRORs on new pulp and paper investments in Canada. As our results in Chapter 5 indicated, profitability in pulp and paper is strongly sensitive to the exchange rate, and the Canadian dollar was seriously over-valued by 1976. Changes in the Canadian tax system that provided more up-front incentives to Canadian corporations in all industries in the 1970s reduced effective tax rates as well, and this too contributed to an improvement in private rates of return.

Canadian firms based part of their case for government assistance on the emergence by the mid-1970s of a substantial labour productivity gap between Canadian and American producers. As data in Chapter 3 indicated, this productivity gap was centred on the newsprint sector, reflecting very noticeable differences in Canadian and American newsprint machine vintages. The older Canadian newsprint mills often required twice as many manhours of labour per ton as U.S. mills. Our comparisons have deliberately avoided the vintage problem by examining state-of-the-art pulp and paper investments in the two countries. In situations in which investments are bulky and long-lived, interregional labour productivity comparisons inevitably reflect variations in the historical timing of capital expenditures in the regions. Much of eastern Canadian newsprint capacity was installed in the 1920s, while the first newsprint mills in the southeastern U.S. date only from the Second World War and most mills have been brought into production since the mid-1950s. The Canadian industry's argument that the presence of low-productivity facilities in Canada in the 1970s was a sign that Canadian locations had become uncompetitive has to be viewed with skepticism. The real issue, and the one that we have addressed here, is not *existing* capacity

but rather rates of return on *new* capacity. Indeed, the presence of older facilities with lower labour productivity in some locations is completely normal and rational, since *continuous* updating is uneconomic.

Given the variations in tax systems and factor prices (including wood costs) in the two economies, we have found that the depreciation of the Canadian dollar in 1977 and 1978 restored Canada's competitive position relative to the U.S. in newsprint and kraft pulp, where 'competitive position' is measured by relative after-tax IRORs on new investments in the two economies.

An overvalued currency obviously creates difficulties across a broad range of export- and import-competing sectors in an open economy. A modernization program directed to outdated manufacturing plants in the *particular industry* can hardly be described as an appropriate response to a macroeconomic disequilibrium. Indeed, under almost any circumstances, firm-specific capital subsidies are very difficult to justify on economic efficiency grounds. Usher (1983) sets out two criteria that should be met before a government considers introducing such subsidies. First, private rates of return should fall short of the hurdle cost of capital to private investors. Second, social rates of return on assisted projects ought to exceed the hurdle cost of capital. As we indicated above, the first of Usher's criteria does not apply to the post-depreciation period: once the Canadian dollar declined in 1977–78 from approximately par with the U.S. dollar to the range of $.80-.85 U.S., private rates of return on Canadian pulp and paper projects were well able to meet market-determined capital costs. Before 1977, however, prospective rates of return calculated on the basis of par values were probably too low to spark new pulp and paper investments in Canada.

This brings us to Usher's second criterion. Can it be argued that before the depreciation of the Canadian dollar social rates of return on pulp and paper investments exceed hurdle costs of capital, even though the latter may have exceeded private rates of return? We have not encountered any arguments that would allow an affirmative answer to this question at the level of either the individual pulp and paper firm or the pulp and paper industry in general. It might be possible to invoke a very broad market failure argument that an overvalued exchange rate can drive private rates of return on investment in an open economy below the 'social' returns that might be calculated on the basis of the 'correct' (i.e., lower) exchange rate. But this is a very general problem that involves numerous distortions, including the discouragement of investment across a broad range of export- and import-competing industries and an inappropriate mix in current trade flows. The pulp and paper industry was only one of many sectors adversely affected by exchange-rate disequilibrium between 1972 and 1977. A broad-based problem requires broad-based solutions, and the capital grants to pulp and paper firms did *not* constitute just one part of a larger policy to encourage investment across a wide range of industries.

Any argument in favour of the grants based on exchange-rate considerations is further weakened by the actual timing of the grants (see Chapter 2). The grants began in 1979, after the value of the Canadian dollar had declined into the range examined in our profitability calculations in Chapter 5. There is little question that the federal and provincial decisions to provide special grants to pulp and paper firms were influenced by the overvalued Canadian dollar, but policy-makers did not reassess those decisions as the value of the Canadian dollar dropped in 1977 and 1978.

Assuming that corrections for differences between social and private returns to different kinds of investment are not part of the problem, economic theory implies that sector-specific investment grants will lead to misallocation of resources. Returns to capital in the sector receiving grants increase (see Table 5.10), and investment tends to flow into the subsidized sector. This influx eventually lowers rates of return in that sector (exclusive of the subsidies) relative to rates of return in other sectors and relative to the cost of capital.

The implementation of a program of firm-specific capital subsidies raises other, related problems. Any type of subsidy involves a redistribution of income from the general taxpayer to the recipients of the subsidy. The latter will include shareholders but may also include labour if unions are successful in transforming part of the subsidy into an increase in wages through rent-seeking activity.

Firm-specific capital subsidies of the type implemented by the Pulp and Paper Modernization Program create significant inter-firm equity problems. Companies that carried out modernization projects prior to the availability of the subsidies received less benefit from the grants than did firms with capital of older vintage. When the least efficient firms are rewarded more than the most efficient firms, the result is not only an equity problem but a moral hazard problem as well: firms may learn that it pays not to modernize using private funds but rather to wait until governments appear with subsidies.

These ideas were expressed when the grants were announced—expressed not by economists, but by executives of some of the pulp and paper companies. The following reactions appeared in the July 1979 issue of *Canadian Pulp and Paper Industry*:

> The concept or idea of governments collecting taxes from all citizens, on a presumably equitable basis, and then granting or giving a part of these funds to selected competitive profit making ventures within the economy is fundamentally unsound. (W. Lawson)

> It is difficult for us to perceive either equity or merit in government policies that tax our hard-earned profits to fund subsidies for our competitors in world markets . . . subsidies are unnecessary. In fact, subsidies are often counter-productive in that they tend to delay the phase-out of obsolete facilities rather than stimulate their replacement. (C. Knudsen)

The proposed incentive grants effectively penalize the farseeing and innovative firms and tend to be indiscriminate regarding the quality of such investment. (D. Lanskail)

These criticisms from industry representatives are not really inconsistent with the pressure that the industry in general brought to bear on federal and provincial governments to assist in stimulating capital spending in pulp and paper. Negative reactions to the grants tended to emanate from firms that had already brought their plants up to date, while the operators of older plants (eastern Canadian newsprint mills in particular), or firms planning major capital programs anyway, tended to support the grants. As we noted in Chapter 2, the CPPA recognized the mixed reactions of its members to modernization grants in the 1970s and put its influence behind special investment tax credits for pulp and paper corporations. A recent report from industry representatives to the Minister of Trade and Commerce and Regional Economic Expansion contains the following view:

On the issue of grants for modernization, the Advisory Committee has been unable to reach a consensus. Some members feel that such grants should be replaced by the broadly-based, evenhanded incentives that can be provided through the tax structure. Others feel that modernization grants do have a place, particularly when special circumstances in an industry demand heavy investment for this purpose and the funds are simply not availble. (Canada 1983, 8)

Some of the assumptions in this quotation are open to serious question. First, while we are inclined to agree that tax incentives are superior to firm-specific grants as a subsidization technique, we do not advocate subsidization in any form. (Our town tax system recommendations, based on the empirical evidence reported in Chapter 5, were outlined in the first section of this chapter.) The notion that 'funds are simply not available' is a puzzling one, given the presence of North American capital markets that permit large capital projects to be funded through new bond or equity issues.

The Pulp and Paper Modernization Program must be judged to have been a wholly unnecessary, and even harmful, policy initiative. By the time it was actually introduced, rates of return on new projects had recovered to the extent that firms did not use the grants in order to meet market-determined costs of capital. The program involved income transfers, inter-firm discrimination, and effects on the allocation of capital funds across Canadian industries that were, and are, inconsistent with fairness and with the efficient operation of the private sector. Further, although the pulp and paper industry, like most interest groups, favours lower fiscal burdens for its own members, the modernization program received very mixed reviews from industry representatives at its inception in 1979 and has not improved in popularity since.

GROWTH PROSPECTS AND RESOURCE CONSTRAINTS

The favourable relationship, reported in Chapter 5, between after-tax IRORs on new pulp and paper investments in Ontario relative to other eastern North American locations and capital costs implies that Ontario is capable of attracting the capital investments needed to operate fully modern pulp and paper mills in the province without public assistance. In keeping with this conclusion, and for efficiency and equity reasons as well, we recommended against capital subsidies in the previous section.

The presence of favourable profit opportunities in Ontario's major pulp and paper manufacturing activities is certainly a *necessary condition* for investment and capacity expansion. But as a primary manufacturing sector integrated backwards into timber supplies, newsprint, and kraft pulp production in Ontario also requires, as a *sufficient condition*, the presence of adequate provincial wood supplies at reasonable cost.

Economic theory suggests that, under competitive market conditions, the timber resource constraint can be brought directly into profitability calculations. If wood starts to become scarce, for example, bidding for stumpage and for pulp wood will operate to increase wood costs to the primary manufacturing sector. Increased costs, in turn, will reduce the calculated values of after-tax IRORs on investment and, in the long run, bring the level of pulp and paper capacity (along with capacity in other wood-using sectors, principally lumber) into conformity with available resource supplies at 'normal' rates of return on capital. The resource constraint, if it is important, is translated into efficient pricing information, which, in turn, is incorporated into profitability calculations and capacity plans. So the sufficient condition of resource availability is simply absorbed into the necessary condition of profitability, *provided free markets for the resource exist*.

Throughout most of Canada's pulp and paper producing regions, the latter proviso is not met. Stumpage prices and pulpwood prices do not reflect the operation of free markets. Timber supplies are predominantly owned by the provincial Crown, and pulp and paper mills obtain their wood supplies from specific geographical timber limits more or less adjacent to their manufacturing operations at stumpage prices set unilaterally by the Crown. Supply and demand for the resource play virtually no role in the Crown's pricing decisions. Consequently, rates of return on investment in pulp and paper manufacturing can be calculated by including wood costs among other costs of production; the availability of wood, like a minimum level of profitability, is a constraint that has to be accepted in advance in the decision to proceed with vertically integrated projects.

Given this constraint, it is apparent that our conclusion that kraft pulp and

newsprint investments in Ontario offer rates of return conducive to the construction of new mills in the province must not be assumed to imply the stronger conclusion that significant expansion of the province's vertically integrated pulp and paper sector is feasible. To reach the latter conclusion, we would have to supplement our favourable profitability results with evidence that Ontario's timber supplies are sufficiently elastic to accommodate a number of new mills. If this elasticity is not present, our profitability conclusion can be taken as a signal that the industry has solid survival potential but little or no growth potential. That is, the construction by a new entrant of, say, an optimal-sized kraft pulp mill in the province would require the retirement of sufficient existing capacity to free up the wood supplies needed by the new mill.

Ontario's timber supply position does not, in fact, appear to be adequate to support expansion of its wood-using industries. Indeed, some foresters contend that existing pulp and paper mills and saw mills will have a difficult time finding adequate supplies in the near future. Wood supply arguments are difficult to resolve, partly because an exact calculation of what is available is inherently difficult, owing to the size and heterogeneity of the provincial forest base and the limited human resources of the Ontario Ministry of Natural Resources (OMNR), and partly because of shifting decisions as to which areas of the forest are to be withdrawn from timber production and devoted to other uses (parks, wilderness areas, etc.). In addition, the fraction of the growing stock that is eligible for harvesting during any particular period depends upon how long stands are to be allowed to grow prior to cutting (the rotation period) and how rapidly stocks of old-growth timber (beyond rotation age) are to be converted into final products.

The length of rotation periods and the rate at which old-growth timber stocks should be liquidated are the subjects of lively debate between forest managers and economists. We shall not attempt to contribute to (or even to summarize) this debate, except to say that Ontario's measured timber supplies reflect an allowable annual cut (AAC), determined by the OMNR, under which rotation periods are longer than economic principles of capital theory support and under which the province's old-growth forests are being fed into the timber supply stream more slowly than many economists recommend. If economic principles were applied rigorously, wood supplies in the province would increase over the short term above the OMNR figures and would subsequently decline to levels below the ministry's projections. The ultimate impact on ACCs after fifty years or more is harder to judge; it would depend on regeneration success and the total land area under sustained timber management.

To illustrate the current supply situation under existing management principles and the range of estimates being reported, we can refer to several studies that provide current ACC calculations. The Canadian Forestry Service (1984) reports

Ontario's ACC figure as 10.8 million cunits (30.3 million cubic metres) of softwoods, which are the principle species used by both the pulp and paper and the lumber sectors. This figure is, in fact, derived from a 1976 study done for the CFS (Bowen 1982). A subsequent study for the CFS (Reed 1978) reduced this softwood figure to just under 10 million cunits per year. Further downward revisions followed. In 1980, Reed reported the softwood allowable cut at 7.8 million cunits (Reed 1980a). In Reed (1980b), a preliminary figure of 9.7 million cunits was reduced to 6.9 million cunits by subtracting inaccessible forest areas and areas removed from commercial production. This drop over the past decade in the calculated timber supply figures for Ontario would appear to be the result of both more realistic assessments of the resource and withdrawals of forest land for other (exclusive) uses.

The current view, as represented by Reed's work and recent comparisons of wood requirements and availability prepared for the Ontario Royal Commission on the Northern Environment (Ontario 1981), is that existing wood-using operations in the province require at least 80 to 90 per cent of the current provincial softwood ACC to function at normal capacity. Current AAC figures may be revised downward as further reassessment takes place in the 1980s and may also drop to reflect decreasing reliance on once-for-all liquidation of old-growth timber stands on lands being converted to long-term management (the so-called 'falldown effect'). If the accessible softwood ACC falls below 6.5 million cunits over the next fifteen to twenty years, it will not be possible to meet current industrial requirements under the OMNR's timber supply plan.

Hardwoods are of less significance than softwoods in the overall picture. The total hardwood AAC of 4.1 million cunits confronts estimated overall net requirements of .7 million cunits, for a surplus of 3.4 million cunits. No 'falldown effects' have been estimated for hardwood supplies. Currently, 88–90 per cent of total wood requirements are for softwood pulp, and so it is with respect to these species and the products associated with them that the supply problem arises.

The softwood timber supply constraint means that overall pulp and paper capacity in the province cannot be increased. The presence of a hardwood surplus in the province does not alter this conclusion, first because the falldown effect for softwoods is likely to force producers into increasing the hardwood proportion in pulp furnishes anyway, and second because the substitution of hardwoods for softwoods will lead to lower yields for the same paper strength, owing to the shorter woodfibres of the hardwoods.

It is true that existing facilities can improve their pulp and paper yields somewhat by adopting state-of-the-art technology. Thus the greenfield newsprint mill described in Chapter 3 uses a thermo-mechanical pulping (TMP) process that can raise yield above the yield of the traditional chemical pulp/ groundwood pulp

combination for newsprint manufacture. But the gain is slight. It is also likely that, beginning in the middle to late 1980s, softwood pulpmills will begin to use much higher yield processes than the kraft technology. Chemi-thermo-mechanical pulping (CTMP), for example, is claimed to be capable of reducing softwood requirements per ton of pulp to about one-half of the wood requirements typical of sulphate (kraft) pulping. If high-yield technologies of this kind do come into use, the eventual replacement of Ontario's sulphate pulp facilities with CTMP mills will permit capacity expansion without additional depletion of the province's timber supplies. But this development lies in the future: *existing* pulp capacity, combined with the demands from other sectors on timber supplies, still means that the resource base cannot accommodate significant increases in capacity over the next few years.

The virtually zero-growth situation confronting the industry over the short to medium term could change in the long term if higher yield processes allow further growth with constant AACs. However, forest management in the province has not in the past produced satisfactory regeneration results: in the long term—twenty-five years in the future and beyond—AACs may have to be reduced because of regeneration failure. It is obviously impossible to predict the balance of wood requirements and availabilities over the longer run, and we shall make no attempt to do so.

Once timber supply limits have been reached, as is now the case, new supplies cannot be located to support capacity growth. As we mentioned above, timber supplies in Ontario are not usually allocated by market processes (there is some relatively minor timber sales activity, most of it in the southern areas of the province). Pulp and paper firms draw on licenced areas and on Crown management units that are complementary to the needs of specific mills. Lest this arrangement be viewed as *a priori* inefficient, it should be noted that the presence of long-term timber supplies is a precondition for capital investment in the industry: without supply assurance on fairly predictable terms, new investment cannot be attracted to the industry on reasonable terms. The appearance of a system of Forest Management Agreements (FMAs) in the early 1980s, under which pulp and paper companies agree to act as contractors in the forest regeneration process in exchange for supply security based on successful reforestation, has strengthened the traditional complementarity between producing facilities and timber supply areas.

Suppression of the market mechanism for the allocation of wood supplies means that the decision to prohibit additional capacity and to allocate supplies among existing users must be an administrative one. New producers have to be discouraged from entering the industry, not by high prices for resource inputs, but by the physical inability of the Ministry of Natural Resources to allocate new

timbersheds. If errors are made in this process, the result will be overcutting of existing timber supplies and timber shortages in the future and/or excess capacity in the industry. Some observers feel that overcutting is already taking place, and the industry is increasingly aware of the province's wood supply constraint.

The presence of a binding wood supply constraint means that projects evaluated on a greenfield profitability basis cannot be undertaken in the province unless existing capacity is retired, freeing up wood supplies to support the new projects. Our use of greenfield projects to evaluate relative regional profitability does not mean that we favour the wholesale replacement of older mills with new mills involving capital expenditures of the order of magnitude described in Chapter 3. It will be recalled from the discussion in Chapter 2 that a decision to modernize existing plants is likely to dominate the decision to invest in completely new mills over some capital cost range (Figure 2.1). Nevertheless, an entirely new mill is always a possibility, and consequently the presence of favourable after-tax rates of return on such greenfield projects does provide a *conservative* estimate of the profit opportunities available from the use of existing timber supplies in Ontario.

Taken together, the profitability results of the previous chapter with the resource constraints just discussed leads to the conclusion that Ontario's export-oriented pulp and paper sector offers viable returns on investment and is internationally competitive in this sense. At the same time, resource constraints translate this fundamentally sound competitive position into a slow-growth situation for the foreseeable future. The presence of hardwood surpluses and the possibility of raising yields of products from wood inputs may permit some expansion of capacity in hardwood processes, but none at all in traditional softwood products.

Zero (or near zero) growth in production capacity inevitably means a decline in employment opportunities in northern Ontario pulp and paper communities as the industry's labour productivity increases. It is very difficult to predict precise employment implications in advance. Productivity changes tend to be discrete, since the capital investments they accompany are often large. By the middle and late 1970s, many eastern Canadian newsprint mills were badly in need of extensive modernization. In theory at least, *very* extensive modernization of Ontario's newsprint sector during this period could have reduced manhour requirements by 50 per cent or more. Of course most projects will not duplicate the productivity of greenfield operations, nor will sweeping modernization occur during any period of a few years. Nevertheless, many of the newsprint modernization projects that drew federal-provincial modernization grants during the 1979–84 period have had or will have significant employment effects. An example is the shift from sulphite and stone groundwood newsprint manufacture to thermo-mechanical pulping (TMP) accompanied by the rebuilding of newsprint machines planned for

Boise Cascade Canada's mill at Kenora. The company announced at the end of 1981 that 392 out of 900 jobs (43 per cent) would be lost, though a number of provisions were made for retraining and for recouping these losses in woodlands operations and at the company's other mill at Fort Frances (Thunder Bay Chronicle Journal, 30 December 1981). Kenora newsprint capacity was expected to increase by 58 tons per day (about 8 per cent of capacity at that location—see Table 1.1). The company's estimated cost for the project was $250 million, or approximately $300,000 per daily ton. This is not far short of the greenfield costs of a 550 ton per day newsprint operation in 1982, which we have estimated at $190 million or $345,000 per daily ton. Most of the modernization projects subsidized under the government program were less extensive than the one planned by Boise Cascade in late 1981 and the predicted job losses were much lower. Furthermore, Boise Cascade's plans, like the plans of a number of other firms, were delayed and altered as the 1981–82 recession took hold. By the beginning of 1984, Boise Cascade had decided to alter its original TMP plans to a high-yield sulphite proposal and to rebuild only one of its three paper machines for the time being. Estimated job losses were reduced from 392 to just over 300.

In 1980, the entire Ontario modernization program was estimated to involve the loss of 600 to 800 jobs in the pulp and paper industry, or just 4 per cent of pulp and employment in Ontario at that time. This loss was to take place over four to five years as the new projects replaced older vintage capital. In addition, the lost jobs represent a bulge of capital-deepening expenditure in the industry that is well above the year-to-year average for Ontario and for the country as a whole. Still, as the Boise Cascade example illustrates, job losses that appear to be manageable when viewed on an aggregate sectoral or provincial basis can create large and worrisome effects in local and isolated labour markets such as Kenora's.

Our opposition to firm- and industry-specific capital subsidies by no means implies that we are opposed to labour market adjustment assistance. On the contrary, this kind of adjustment assistance makes it easier for the pulp and paper industry to move ahead with modernization plans (as warranted by the results of project evaluation) with the knowledge that job losses in some sectors and localities can be made good through retraining, labour adjustment benefits, and mobility assistance. Other research undertaken for the Ontario Economic Council (Saunders 1984) evaluates current government policies available to deal with job losses and recommends a number of changes designed to improve the efficiency and fairness under which labour market adjustments take place.

NOTES

1 An excellent description of 'safe harbour' leasing is given by Galper and Toder (1983).
2 Boadway (1978) argues that if accelerated depreciation schemes were uniformly applied, long-lived assets would be favoured more than short-lived assets. The reason for this is that the present value of tax savings is greater for assets with, say, a twenty-year life than it is for assets with a ten-year life when both assets are accorded a two-year write-off.
3 This issue is discussed in detail in Meade (1978) and in Boadway, Bruce, and Mintz (1982).
4 See, for example, Boadway, Bruce, and Mintz (1981).
9 Thunder Bay *Chronical Journal*, 30 December 1981.

7
Summary and Conclusions

The major aim of this study has been to determine whether or not an Ontario location is a viable one for the production of newsprint and kraft pulp. The question is an important one, since the pulp and paper sector is responsible for a significant portion of the province's manufacturing employment. In recent years, both the industry and the federal and provincial governments have expressed concern that the costs of producing newsprint and kraft pulp in Ontario exceed, or are likely to exceed, production costs in alternative locations. In particular, there has been concern that production costs in the southeastern United States relative to those in Ontario imply that Ontario is not a viable location for pulp and paper production.

Using 1982 production costs, we have derived both before-tax and after-tax internal rates of return for investments in newsprint and kraft pulp manufacturing facilities in the three major eastern North American locations: Ontario, Quebec, and the southeastern United States.

The analytical framework adopted in this study makes it possible to draw a clear distinction between the effects of pure locational factors on profitability and the effects of different tax environments on profitability. Before-tax rates of return are determined, given exchange rates, by relative factor costs and are free of tax-induced effects. Consequently the before-tax IRORs derived in this study serve as an index of the effect of location (relative production costs) on the profitability of investment in new pulp and paper production facilities. The corporate tax system in operation in a given region will modify the locational advantage or disadvantage inherent in that region. A region enjoying a pre-tax absolute cost advantage over another region may, given the corporate tax system, enjoy a greater or lesser after-tax advantage. In this context, we have analyzed the effect on the after-tax profitability of investment in a given region of a change in the corporate tax system in that region and the effect on after-tax profitability of imposing the same tax system on all three regions.

We have also examined the effect of different assumed values of the Canadian dollar *vis-à-vis* the U.S. dollar on the before-tax and after-tax profitability of an Ontario location. Given that the bulk of Ontario output is sold in U.S. markets, the exchange rate is clearly an important factor. Our model also considered the effect on before-tax and after-tax profitability of fully anticipated inflation rates of 5 and 10 per cent.

Finally, we have examined the question of whether or not the extensive program of federal and provincial capital subsidies to the Ontario industry over the period 1979–84 was justified. To do this, we derived after-tax rates of return on investments both with and without the capital grants.

The central conclusion in this study is that given 1982 production costs in the three regions and assuming a value for the Canadian dollar of not more than $.86 U.S., an Ontario location yields before-tax and after-tax rates of return that are fully competitive with those obtainable on similar investments in the southern U.S. This is an important conclusion, since production from locations in the southern U.S. represent the major source of competition for Ontario producers in U.S. markets. The empirical results clearly indicate that an Ontario location affords an adequate rate of return on investment relative to the cost of capital, and that in consequence capital subsidies are unnecessary. We have also argued that firm-specific capital subsidies of the type introduced under the modernization program can be criticized on both efficiency and equity grounds.

Our results show that marginal effective corporate tax rates are considerably lower than nominal (statutory) tax rates. In particular, we have shown that effective corporate tax rates are extremely sensitive to the treatment accorded to depreciation allowances and investment tax credits.

Differences in marginal effective corporate tax rates across regions exert an important influence on industrial location. Indeed, we have shown that tax system effects can be at least as important as regional factor price and productivity differentials in determining the most profitable location for investments in pulp and paper facilities. The pre-1981 Canadian corporate tax system offered significant advantages to Canadian locations and drove a smaller wedge between before-tax and after-tax IRORs than any of the other tax systems analyzed. The pre-1981 U.S. tax system drove the largest wedge between before-tax and after-tax IRORs and in consequence made locations in the U.S. less attractive than Canadian locations. Changes in the Canadian and American tax environments since 1981 have considerably narrowed the differences between the two countries' effective tax rates, which have declined in the U.S and increased in Canada.

The empirical results reveal a significant difference between the treatment of old firms and the treatment of new firms under the Canadian corporate tax system. The fact that depreciation allowances and investment tax credits are not

marketable means that the real value to a firm of these allowances and credits depends upon pre-existing tax liability. We have shown that firms with enough pre-existing tax liabilities to take immediate advantage of the built-in tax incentives face considerably lower effective tax rates than do firms without enough pre-existing tax liabilities to take immediate advantage of the incentives. Thus the corporate tax system in Canada acts as a potentially significant barrier to entry. This distortion would be eliminated by the introduction of marketable tax credits and depreciation allowances.

We have shown that the presence of anticipated inflation has a negative effect on after-tax IRORs. The impact of inflation on after-tax IRORs depends in part on the rate at which depreciation is allowed for tax purposes. We have shown that the closer depreciation for tax purposes comes to immediate expensing, the smaller is the effect of inflation on after-tax IRORs. Given the relatively high degree of acceleration of depreciation allowances built into the Canadian tax system, the effect of moderate levels of inflation (up to 10 per cent) on after-tax IRORs is quite small.

We have argued that although our analysis of tax systems is specific to the pulp and paper sector, the available empirical evidence shows that the results derived in this study are fairly representative of manufacturing industries as a whole.

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THE ONTARIO PULP AND PAPER INDUSTRY

Internal rates of return in Canadian manufacturing

One of the main determinants of investment in any industry is the internal rate of return (IROR) on capital expenditures on new facilities. In a new Ontario Economic Council research study entitled ***The Ontario Pulp and Paper Industry: A Regional Profitability Analysis***, Professors F.J. Anderson and N.C. Bonsor of Lakehead University develop a new methodology to estimate IRORS and examine some of the issues to which they give rise. They consider the extent to which differences in regional costs and tax systems affect IRORs in various regions, how Canadian IRORs fluctuate in response to changes in the value of the Canadian dollar, how inflation affects after-tax IRORs and how they are influenced by the tax system.

The authors conclude that *Canada's corporate tax structure discriminates heavily against new firms and investment in structures*, and they criticize the excessive number of arbitrary changes made in Canadian corporate taxes in recent years.

The authors also say:

> 'The empirical results reveal a significant difference between the treatment of old firms and the treatment of new firms under the Canadian corporate tax system. The fact that depreciation allowances and investment tax credits are not marketable means that the real value to a firm of these allowances and credits depends upon pre-existing tax liability. We have shown that firms with enough pre-existing tax liabilities to take immediate advantage of the built-in tax incentives face considerably lower effective tax rates than do firms without enough pre-existing tax liabilities to take immediate advantage of the incentives. Thus the corporate tax system in Canada acts as a potentially significant barrier to entry. This distortion would be eliminated by the introduction of marketable tax credits and depreciation allowances.'

They also find that inflation does not appear to have affected Canadian IRORs in a serious manner, but fluctuations in the value of the Canadian dollar have had a considerable effect. A fall in the value of the Canadian dollar tends to raise IRORs in Canadian manufacturing and a rise tends to reduce them.

The Ontario pulp and paper industry

The authors use their new methodology to provide an in-depth analysis of the pulp and paper industry in Ontario. This study and its findings are extremely important since pulp and paper mills are the leading manufacturing sector in the country, accounting for nearly five per cent of Canadian production workers in manufacturing and 7.6 per cent of value-added in manufacturing. Pulp and paper activity is somewhat less important to the Ontario economy, ranking fifth in terms of value-added (behind motor vehicle parts, iron and steel mills, motor vehicle manufacturers, and miscellaneous machinery and equipment) and sixth in terms of production workers (behind the sectors just listed and commercial printing as well).

Still, approximately 2.8 per cent of Ontario's manufacturing employment and 3.5 per cent of value-added in Ontario manufacturing originate in the pulp and paper sector.

Resource-oriented pulp and paper production is crucial to the economic life of many communities in northern Ontario. Towns such as Iroquois Falls, Kapuskasing, and Dryden owe their existence to the industry, and larger centres such as Thunder Bay count pulp and paper activity as a key component of this export base.

Any reduction in the level of production in the newsprint and kraft pulp sectors would require a significant reallocation of Ontario's supplies of labour and capital, both from pulp and paper to other industries and from northern resource towns to other areas of the province.

The implications of an Ontario location for pulp and paper production

One of the main concerns of the study was to determine whether an Ontario location was a viable one for the production of newsprint and kraft pulp. In recent years, both the industry and the federal and provincial governments have expressed concern that the costs of producing newsprint and pulp exceed, or are likely to exceed, costs in alternative locations. In particular, there has been concern that production costs in the southeastern United States relative to those in Ontario imply that Ontario is not a viable location.

The authors conclude that 'the profitability and competitiveness of Ontario's [pulp and paper] industry is clearly satisfactory at present, although this will continue to depend upon the Canadian exchange rate.'

Modernization grants to the industry

After studying IRORs in the Ontario pulp and paper industry, the authors conclude that the substantial grants made under the 1979 Pulp and Paper Modernization Program were unnecessary:

> [Our] empirical results clearly indicate that an Ontario location affords an adequate rate of return as investment relative to the costs of capital, and that in consequence *capital subsidies are unnecessary.*

Capacity limits and employment

The authors find that the limits of wood supply in the province have been reached, and this implies that the industry can provide little if any new employment:

> Policymakers must realize that pulp and paper cannot provide a stream of new jobs for the future. Because of the resource constraint it is more likely that some existing jobs will be lost as modernization proceeds.

The authors recognize the resource-base constraint, but they also find that the pulp and paper industry's competitive cost position is favourable, so that further

expansion of the province's capacity would be economic if wood supplies were available.

Though some jobs may be lost through modernization the long-run survival of the existing mills is relatively secure.

Looking back

There was a crisis atmosphere in the 1970s. Apart from the depression of the 1930s and the 1981-2 recession, the mid-1970s was the most difficult period ever faced by Canadian pulp and paper firms.

'Between 1971 and 1976, prices in Canada rose at about 10 per cent annually, while in the United States the inflation rate was about seven per cent. Yet the Canadian dollar remained approximately at par with the US dollar over this period. Consequently, given purchasing power parity in 1971, the Canadian dollar was overvalued by at least 15 per cent by the end of 1976. On the basis of par values, average hourly earnings in Canadian and U.S. pulp and paper mills were approximately equal in 1971, but by 1976 Canadian hourly earnings were 25 per cent higher than earnings in U.S. mills.'

The Canadian industry communicated its concern about the effects of the strong Canadian dollar on their relative cost position to federal and provincial government officials. They argued that while modernization was essential to the reduction of mill labour costs, modernization investments were unlikely to earn adequate rates of return.

'Apart from long-standing differences in wood costs and transportation cost disadvantages borne by Canadian mills selling into markets in the northeastern and midwestern U.S., *the major reason for these cost differences was the overvalued Canadian dollar. Net capital inflows buoyed up the exchange rate until 1977, when rapid depreciation began. As long as the Canadian dollar remained at par, Canadian operating costs were too high.*'

The government reponded to these requests with some assistance programs. These are analyzed in detail in the study. The authors point out, however, that though the

interaction with the Canadian dollar has changed drastically, the government assistance has continued without any reassessment of the need.

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The Ontario Pulp and Paper Industry: A Regional Profitability Analysis, 104 pages, price $4.50, is available at the following outlets:

The Ontario Government Bookstore, 880 Bay Street, Toronto, to those shopping in person. Out-of-town customers may write: Publications Section, Fifth Floor, 880 Bay Street, Toronto, Ontario, M7A 1N8, or telephone 965-6015 (toll-free long distance, 1-800-268-7540; in northwestern Ontario, 0-Zenith 67200). A cheque or money order, payable to the Treasurer of Ontario, must accompany all mail orders.

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Ontario Economic Council Research Studies

32 The Ontario Pulp and Paper Industry: A Regional Profitability Analysis

F.J. ANDERSON and N.C. BONSOR

Anderson and Bonsor calculate the internal rates of return (IRORs) on capital expenditures in new manufacturing facilities. They calculate IRORs on both a before-tax and an after-tax basis, for new facilities in each of northern Ontario, Quebec, and southeastern United States. This approach enables them to compare competitiveness and profitability among the three areas. They consider the extent to which the differences in costs and tax systems affect the IRORs; in particular, how Canadian IRORs fluctuate in response to changes in the value of the Canadian dollar, how the IRORs of new firms are affected by the current tax systems, and how inflation can alter the after-tax IRORs.

The authors conclude that Canada's corporate tax structure discriminates heavily against new firms and against investment in structures. On the other hand, inflation does not appear to alter IRORs in a serious manner. Anderson and Bonsor criticize the excessive number of arbitrary changes to which the Canadian corporate tax system has been subjected. They also argue that the substantial grants under the 1979 Pulp and Paper Modernization Program were unnecessary and objectionable. Although based upon their analysis of the pulp and paper industry, these and other conclusions have relevance for much of Canada's manufacturing sector.

Of special concern to the pulp and paper industry, however, are the limits to Ontario's timber supplies. These resource constraints mean that the pulp and paper industry will not be able to provide a stream of new jobs for the future. Apart from these unfortunate limits, the profitability and competitiveness of Ontario's industry is clearly satisfactory at present, although this will continue to depend very much upon the Canadian exchange rate.

F.J. ANDERSON and N.C. BONSOR are both professors in the department of economics at Lakehead University, Thunder Bay, Ontario

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